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Textile Markings As Hostages of Quality

By WALDON FAWCETT

Significance would attend the advent of any single new or intensified influence which would operate to induce the trade and the consuming public to place added dependence upon textile markings for purposes of specification and verification. How much more interesting, then, is the current situation in which we find not one but two major influences operating to this end from different angles. With maintenance and insurance of textile integrity the objective in both movements, the dyeing phase of the industry is intimately involved.

ONE development which must operate to invest with deepened importance the policies and practices of marking textiles is the progress of the industry-wide movement for a return to quality standards in merchandise. Parallel with this, though distinct from it, yet interlocking in its influence upon the public mind, is the conversion of important branches of the industry to the "commercial standards," so-called, sponsored by the Federal Government. From this compliance—as exemplified, for example in the "pure dye" rayon standards, now under consideration by the industry—it may well be but a short step to the extensive adoption for textiles of the "quality-guaranteeing labeling" system which the Department of Commerce has promoted energetically this past few years.

The circumstance that requires continual recognition, for comprehension of the new scene, is that one of the new forces at work is strictly private in character, whereas the other, if the essentially Governmental, exemplifies the cooperation of public and private organizations. The National Quality Maintenance League may accomplish its purpose of refocusing public attention upon quality rather than upon price without any assistance at Washington. On the other hand, the Government has the entire machinery for formulating and clearing the "standards," such as the definitions now before the rayon industry, which become authoritative upon formal acceptance by 85 per cent of the industry.

Because the machinery of Federal paternalistic standardization at the disposal of the textile industry has grown more complicated in recent years it may be well worth while, at this juncture, to examine the set-up. All phases of the work, destined to stabilize public confidence and expectations, come within the jurisdiction of the National Bureau of Standards. Yet is the program apart, in the main, from the research work which the *American Association of Textile Chemists and Colorists* has conducted for some years past by means of technical associates stationed at the Bureau of Standards.

In the beginning, the Division of Simplified Practice at the National Bureau of Standards obtained so much publicity for its efforts to eliminate superfluous variety in industry that many business men obtained the impression that this constituted the full scope of Governmental activity in this quarter. As a matter of fact the Simplification subsidiary is but one of four major projects under the heading "Commercial Standards." The Simplification sub-section concerns itself almost exclusively with commodity sizes and dimensions rather than the character or composition of the merchandise to be put "into uniform."

Making more intimate contact with the textile industry, and with textile chemistry in particular, is the Division which takes the name of the group, i.e., the Division of Commercial Standards. This agency is organized to cooperate upon request with any industry or subsection of an industry (even as it is today helping the rayon industry) in the selection and establishment of definite grades and qualities as commercial standards. Yet another wheel within the wheel of commercial standardization, centralized at the Bureau of Standards, is that devoted to the promulgation of nationally-recognized specifications and the compilation of lists of willing-to-certify

manufacturers of products made according to these specifications.

It is recognized by all who have studied the proposition that the success of the entire project for the official-inter-industrial certification of grades, quality, etc., will depend upon the ability of the promoters to set up commercial standards, so obviously fair and broad in application that permanency is assured. Accordingly, in evolving national commercial standards, ample safeguards have been provided to insure full cooperation and coordination without domination by any group in an industry in the selection and approval of the industry's standards. The chief role of the Bureau of Standards in furtherance of specifications and standards in the textile industry is frankly promotional in character. And especial effort is directed to the application of the certification plan for the assurance and convenience of small purchasers. The Standards Bureau is particularly well positioned to feel the pulse of the textile industry in respect to commercial standards because, in addition to the contact via the Research Committee of the *American Association of Textile Chemists and Colorists,* the Bureau has continuous liaison with Advisory Committees on cotton, wool, hosiery, underwear, etc.

Even if an observer or participant were not enthusiastic regarding the efficacy of the quality-guarantee labeling system, he would be constrained to concede the influence upon purchasers of this device for facilitating the use of nationally recognized commodity specifications. In the textile field, to date, thirty-three specifications have been covered by the warranty labeling and 191 firms have qualified as sources of attested quality. The inevitable consequence of quality-certifying labeling must be, of course, to cultivate on the part of buyers the habit of noting and translating all the markings on goods. Even as the U. S. Food and Drug Administration has been engaged for some months past in a "Read-the-Label" campaign addressed to the general public, so the National Bureau of Standards may be said to, in effect, be carrying on a read-the-label crusade directed to purchasers at wholesale as well as at retail.

With all due respect for the persuasion of the Federal standardization and certification enterprises in cultivation of consumer-vigilance and the habit of verification in buying, it is a question whether, after all, the stronger influence to this end may not come from the trend to purchase of quality. Certainly the force of this factor will be the stronger of the two if producers and processers avail themselves of their opportunities to signal the presence of quality in merchandise by the use of private marks—brands and nicknames or distinguishing symbols eloquent of specific quality in the individual article or the pledge of general quality inherent in the reputation of the producing house.

Textile markings are bound to come to new status as hostages of quality as a result of the latter-day legal recognition of the functions of grade marking. There has long been a tradition in business circles (not without some judicial basis) that a trade mark could not function as a grade mark, nor vice versa. Latterly, this insistence on rigid separation has been considerably modified. It is recognized that a mark which starts its career as an otherwise meaningless mark of ownership or origin may come, through usage and advertising, to serve as a quality-mark as well as a source-mark. Contributing to the change in conditions is the spread of multiple trade-marking. With this growing habit of employing not one but several marks on the same item it becomes a relatively more simple matter to draft one of the indicia as an intentional or impromptu quality-mark.

The revision of the general code of trade mark ethics which has lately been brought about by the new "supreme court of trade marks" (U. S. Court of Patent Appeals) is wholly sympathetic to the idea of quality-signification in merchandise-marks. To the same end, with complementary subdivision of responsibility, is the proposal now before Congress to place "service-marks" on a par, legally, with trade marks. Textile dyers have been fortunate in securing recognition for their marks. But, to this day most classes of converters' marks, finishers' marks, etc., are excluded from Federal registration on the ground that the intermediary marks merely betoken a service performed on goods owned by others. Strict censors at the U. S. Patent Office have been wont to borrow the doctrine of a Federal Court which, on occasion, said, with respect to the Fur Dressers & Dyers' Fur Association, Inc., that "the dyeing and dressing of furs does not constitute 'trade or commerce' but is only performance of labor." If all service-marks, for whatever degree of processing, may be pedigreed, the inevitable consequence will be a scrutiny and discrimination by buyers in respect to the quality of ingredients and workmanship in the intervening stages of manufacture.

New Chemical Company

A. H. Mathieu, well known in the chemical field, has formed a new company to manufacture and deal in heavy chemicals, alkalies and specialties such as hydrosulphite, sulphonated oils, acids, salts, etc.

Associated with Mr. Mathieu is Irving D. Hopper, formerly associated with the Second National Bank of Paterson, and the LaFrancaise Piece Dye Works, of which company he was secretary and treasurer, in which capacity he will serve the new company.

Mr. Mathieu was formerly connected with the Sherwin Williams Co. in a sales capacity, specializing in acetic acid.

About 1925 he joined the Olean Sales Corporation, which company claimed the distinction of being the pioneers in the direct process of manufacturing acetic acid in America.

Mr. Mathieu was sales manager of the above company and his new organization occupies the same plant at 7-11 Getty Avenue, Paterson, N. J., which formerly was the home of Olean Sales Corporation.

We are informed that A. H. Mathieu & Co. will, in the near future, manufacture sodium acetate and sal soda.

The Detection and Determination of Small Quantities of Metals in Textile Materials*

A Review of the Methods for Finding the Commoner Metals

By S. R. TROTMAN, M.A., F.I.C.

Although metals are easy to identify when present in considerable quantities, their identification is often very difficult when they occur in traces, or are confined to small areas of the material under investigation. In these cases the ordinary methods of analysis are unsuitable and recourse must be had to microchemical methods or delicate colorimetric tests for both qualitative and quantitative purposes.

MANY of the troubles which arise in connection with both dyed and undyed textile goods may be traced to the presence of small quantities of metallic impurities. Those commonly met with include iron, copper, lead, aluminum, calcium and magnesium, while zinc, manganese, chromium and tin are found occasionally.

Finding Minute Quantities

Quantities of copper, for example, which are too small to weigh accurately may still be sufficient to cause discoloration in dyed goods or the decomposition of a peroxide bleaching bath. Much work has been published recently, dealing with the detection and determination of minute quantities of metals, which may be summarized with advantage since, scattered as it is through various scientific journals, it is not readily available to all textile workers.

Iron.—Iron is of common occurrence in all textile materials and its determination is carried out as a matter of routine. About 5 grm. of the sample are weighed and burned to an ash in a silica or porcelain dish. The ash is treated with hydrochloric acid and a few drops of bromine water and the mixture evaporated to dryness on a water bath. The bromine is required to ensure that the iron shall be present in the ferric condition. The dry residue is extracted with dilute hydrochloric acid, washed into a graduated flask and diluted to the mark with water.

How Iron Is Found

An aliquot part of this solution is placed in a Nessler cylinder, 2 c.c. of a freshly-prepared 1 per cent aqueous solution of potassium ferrocyanide are added, and the mixture stirred with a glass rod. Distilled water is placed in a second cylinder, a drop of hydrochloric acid and 2 c.c. of the solution of potassium ferrocyanide added and a standard solution of iron (containing 0.00001 grm. per c.c.) is run in from a burette until the color has exactly the same depth as that of the first cylinder.

The blue color produced is, of course, Prussian blue, which is insoluble in dilute hydrochloric acid, although decomposed by alkalis. The standard iron solution is made by dissolving exactly 1 grm. of pure iron in nitric acid evaporating the solution to dryness, dissolving the residue in dilute hydrochloric acid and diluting the solution to exactly one litre. Each cubic centimetre of this solution contains 0.001 grm. of iron. When a test has to be made, this solution is diluted 100 times with water.

Wet Combustion

In all cases incineration may be replaced by a suitable process of wet combustion, such as heating with a mixture of sulphuric and nitric acid, until a colorless solution is obtained. A satisfactory method is to start with about 25 c.c. of sulphuric acid and 10 c.c. of nitric acid and add a little potassium nitrate from time to time to the boiling liquid. If compressed balls are used the nitric acid is liberated gradually and the potassium sulphate formed assists oxidation by raising the boiling point of the mixture. Care must be taken to avoid frothing, by heating the mixture gently at first and using a large beaker or flask. Rupp (*Proc. Amer. Assoc. Textile Chem. Colorists,* 1930, 215), digests the sample (10 grm.) with 25 cc. of concentrated nitric acid, 25 c.c. of sulphuric acid and 2 grm. of potassium sulphate. When these wet combustion methods are used, lead, if present, is changed into lead sulphate. If the mixture be diluted with water and allowed to stand, this lead sulphate settles down and may be removed by filtration.

Detecting Copper

Copper.—The detection of copper is often of great importance in textile investigations. A weighted portion of the sample is burned to an ash in a silica or porcelain dish. The ash is treated with hydrochloric or nitric acid and the mixture evaporated to dryness on the water bath. The dry residue is extracted with dilute hydrochloric acid, the liquid filtered off and saturated with sulphuretted hydrogen gas. After standing for about six hours the precipitate is filtered off on a Gooch crucible and washed. The asbestos mat is placed in a porcelain dish, some

*Dyer & Calico Printer.

dilute nitric acid added and the contents of the dish evaporated to dryness. The residue is extracted with hot water and the extract made up to a definite volume. Several delicate tests, are available for both qualitative and quantitative purposes.

(1) *The ferrocyanide test.* An aliquot portion of the solution is placed in a Nessler cylinder, a little ammonium acetate solution added followed by 2 c.c. of a freshly prepared solution of potassium ferrocyanide. A red color due to copper ferrocyanide is produced. For a quantitative determination a second Nessler cylinder is taken, containing water, ammonium acetate and potassium ferrocyanide. A solution of copper sulphate containing 0.00001 grm. Cu. per cubic centimetre is run in until the color matches that of the first cylinder. A standard solution of copper containing 1 grm. Cu. per litre is made, which is diluted 100 times before use. The stock solution may be made by dissolving 1 grm. of pure copper foil in dilute nitric acid, evaporating the solution to dryness and dissolving the copper nitrate in 1 litre of water. The ferrocyanide test cannot be used for copper in presence of iron. The latter may be removed by making the liquid alkaline with ammonia, boiling and filtering off the ferric hydroxide.

Delicate Reagent for Copper

Callan and Henderson (*Analyst,* 1929, 650) found that sodium diethyldithiocarbamate

$$\begin{matrix} & \diagup\, N(C_2H_5)_2 \\ C & = S \\ & \diagdown\, SNa \end{matrix}$$

is an extremely delicate reagent for the detection and colorimetric determination of copper. The solution to be tested is placed in a Nessler cylinder made slightly alkaline with ammonia and 10 c.c. of a 0.1 per cent aqueous solution of the carbamate added. A golden-brown color is produced when only 1 part of copper per million is present. The color can be matched with a standard solution of copper containing 0.00001 grm. per cubic centimetre. The solution must be free from iron and lead. Both may be removed by adding a drop or two of ferric chloride solution, making the mixture alkaline with ammonia, boiling and filtering. Zinc when present is rendered inactive towards the reagent by the addition of from 2 to 5 c.c. of strong ammonia per 100 c.c. of the solution.

Other Tests

Some other delicate tests for copper may be mentioned:

(1) Potassium ethyl xanthate gives a yellow color.

(2) Concentrated hydrobromic acid (free from bromine) gives a red precipitate having the composition $CuBr_2.HBr.2H_2O$.

(3) Clarke and Jones Test (*Analyst,* 1929, 333). The solution which must be free from chlorides is neutralized and then made faintly acid by adding one drop in excess of 1 in 3 sulphuric acid. It is then placed in a Nessler cylinder diluted to 100 c.c. and 1 grm. of ammonium persulphate is dissolved in the solution. After this 1 c.c. of a saturated alcoholic solution of dimethylglyoxime, 0.5 c.c. of 0.5 per cent solution of silver nitrate, and 2 c.c. of a 10 per cent aqueous solution of pyridine are added, and the mixture stirred. When 1 part of copper in 10,000,000 is present a reddish violet color resembling that of permanganate is produced.

Elvehjem and Lindow (*J. Biol. Chem.,* 1929, 435) based a method for the determination of traces of copper upon the fact that when a neutral solution of a copper salt is treated with a few drops of concentrated potassium thiocyanate solution and a few drops of pyridine, a green precipitate of the composition $Cu(C_6H_5N)_2(CNS)_2$ is formed. This is soluble in chloroform and the green color of the solution produced is a measure of its copper content.

Chalk's Investigation

Chalk (*Analyst,* 1930, 187) has studied the method and the action of other metals. Nickel and cobalt give a blue and a pink pyridine thiocyanate respectively. Silver and mercurous salts must be absent since their thiocyanates are insoluble in water. In presence of lead and barium hydrochloric acid must be substituted for sulphuric acid. Ferrous salts do not interfere if oxidized to the ferric state with ammonia and hydrogen peroxide. The excess being removed by boiling. The following method of procedure is recommneded. The solution is made slightly alkaline to phenolphthalein with N sodium hydroxide and sufficient N sulphuric acid added to dissolve any precipitated ferric hydroxide, to a clear yellow solution on standing. About 3 c.c. of acid are usually sufficient. The liquid is transferred to a small separating cylinder. 1 c.c. of 10 per cent tartaric acid, 1 c.c. of 10 per cent potassium thiocyanate, 0.5 c.c. of pyridine and 5 c.c. of chloroform added quickly, the liquid made up to 50 c.c. and shaken for 15 seconds. The chloroform extract is run off into a Nessler cylinder and compared colorimetrically with standards prepared in a similar manner.

Calcium and Magnesium

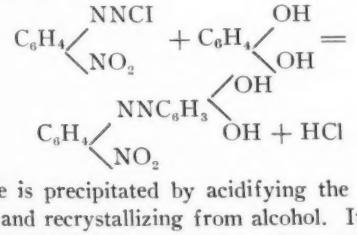
Calcium and Magnesium.—These metals generally occur together and their separation is not so easy as is often supposed, owing to the fact that under suitable conditions magnesium oxalate is precipitated with and absorbed by calcium oxalate. This is particularly marked when only small quantities of calcium are associated with a much larger quantity of magnesium. The separation may be effected in such cases by taking advantage of the fact that calcium sulphate dissolves readily (Singleton, *Industrial Chemist,* 1929, 71). The solution is treated with sufficient sulphuric acid to convert the metals into sulphates and evaporated to dryness. The residue is dissolved in a small quantity of water and concentrated until it becomes pasty on cooling. This residue is treated, with constant stirring, with a mixture of 10 volumes of ether and 90 volumes of methyl alcohol until the volume of the liquid is about 50 c.c. After standing for a short time, the mixture is filtered and the filter washed with a mixture of 5 volumes of ether and 90 volumes of methyl

alcohol. The residue, which consists of calcium sulphate, is ignited and dissolved in dilute hydrochloric acid. The calcium is precipitated with ammonium oxalate and determined by titration with potassium permanganate solution.

Magnesium.—Magnesium may be detected by means of certain dyestuffs, such as Titan Yellow. Kolthoff (*Mikrochemie, Emich-Festschrift,* 1930, 180) gives the following test which (in the absence of nickel, cobalt and manganese, which give a similar reaction) will detect 1 mgrm. per litre. To 10 c.c. of the solution, from 0.1 to 0.2 c.c. of a 0.1 per cent solution of Titan Yellow G are added followed by about 0.25 to 1 c.c. of 4N sodium hydroxide solution. If 1 mgrm. of magnesium per litre is present an orange color is produced which becomes red when 5 mgrm. per litre are present. In the absence of magnesium the mixture has a brownish yellow color.

Use of Titan Yellow

When magnesia, magnesium carbonate or phosphate is boiled with a few drops of a solution of Titan Yellow (Azidine Yellow 5G) in presence of alkali, a violet-red color is formed. A reagent termed "Magneson," which consists of p-dihydroxyazo-p-nitrobenzene (Engel, *J. Amer. Chem. Soc.,* 1930, 53, 1812), is capable of detecting 3×10^{-6} grm. of magnesium. The solution to be tested is evaporated to a small volume or to dryness if organic matter is absent, 5 to 10 drops of 6N sodium hydroxide solution added to the residue and one drop of 0.5 per cent solution of the reagent in 1 per cent sodium hydroxide. In about 10 seconds or more, depending on the concentration of the magnesium, a light blue stain will appear on the portions of the dish which have been in contact with the solutions containing magnesium. If the supernatant liquid is poured off and the stain washed with water, it becomes green but does not disappear. Nickel acts in a similar manner, but the stain becomes red brown on washing. Cobalt gives no stain, but a blue lake. The magnesium stain is not affected by concentrated ammonia, but that produced by nickel dissolves rapidly. The reagent may be prepared by coupling diazotized p-nitroaniline with a solution of the theoretical quantity of resorcinol in dilute alkali.



The dye is precipitated by acidifying the mixture, filtering off and recrystallizing from alcohol. It has a melting point of 199-200 deg. C. In another method of making this test (Ruigh, *Analyst,* 1929, 489), the solution is made just acid with hydrochloric acid, and before adding the reagent (one drop) a sky blue precipitate settles out when the mixture is made alkaline or shaken. Excess of ammonium salts destroy the sensitiveness of the test.

Another delicate reagent for magnesium (Hahn, Wolf and Jager, *Ber,* 1924, 57, 1394) is 1:2:5:8 tetrahydroxyanthraquinone, an alcoholic solution of which gives a bright blue color with 0.001 mgm. of magnesium. When aluminum is present it is kept in solution by adding excess of sodium hydroxide or of tartrate and alkali.

Aluminium

Petraschenj (*Analyst,* 1927, 559) uses a reagent made by treating a solution of iodine (3 grm.) and potassium iodide (6 grm.) in 100-200 c.c. of water with sodium hydroxide solution until it is just discolored. This is added to the cold neutralized solution containing magnesium which must be free from ammonium salts. A dark red precipitate is formed by 0.0024 grm. of magnesium per 100 c.c.

Aluminium.—Aluminium forms a characteristic gelatinous hydroxide which often serves for its identification, confirmed by its solubility in excess of sodium hydroxide solution. When only small quantities are available Atack's test is employed (*J.S.C.I.,* 1915, 936). The reagent used consists of a 1 per cent. filtered solution of Alizarin Red S. To about 5 c.c. of a neutral or acid solution of the solution under examination is added 1 c.c. of the reagent, then ammonia until the solution is alkaline, shown by the production of a purple color. The solution is boiled for a few minutes, allowed to cool and acidified with dilute acetic acid. The production of a red color or precipitate is conclusive evidence of the presence of aluminium. The red salts of other metals are soluble in acetic acid and do not interfere with the reaction. The test will detect 1 part of aluminium in 1 million.

Atack's Procedure

The procedure recommended by Atack is as follows:—"The original solution (5 to 20 c.c.) is acidified with hydrochloric or sulphuric acid, as acetic acid would form the highly dissociated aluminium acetate, and this has been found to give a somewhat more intense coloration than the inorganic salts; nitric acid in considerable amounts leads to the partial destruction of the coloration. 10 c.c. of glycerin and 5 c.c. of a 1 per cent. solution of Alizarin S are added, the solution made up to about 40 c.c. with water and then rendered slightly ammoniacal. After standing for five minutes, it is acidified with dilute acetic acid, the Alizarin S acting as indicator, acetic acid being added until no further change in the coloration occurs. The liquid is then made up to 50 c.c. and compared with a standard. Suitable amounts of aluminium for estimation are 0.005 to 0.05 mgrm., the solution under examination being suitably diluted if necessary.

"The temperature at which the coloration is produced appears to be immaterial, provided the acetic acid is added in the cold. Iron and chromium may be prevented from interfering by conversion into the double citrates by addition of a citrate to the acidified solution before adding ammonia; in this manner it was found that the coloration given by 0.015 mgrm. of aluminium was not affected by the presence of 10 mgrm. of iron."

(Continued on page 431)

The Dyeing Machine---II

By **HENRY BARKER BURKE**

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(Continued from page 410, June 20, 1932, issue)

Dyeing of Piece Goods

Piece-goods which were early dyed by pulling the cut sewed end to end over a smooth bar suspended over a vat (Fig. 7) and thus thru the solution soon evolved a machine peculiar to this type of work, whereby, the smooth bar was replaced by a revolving cylinder or drum placed over the vat and today they remain in a form common three hundred years ago.

Fig. 7
Early Hand Piece Dyeing.

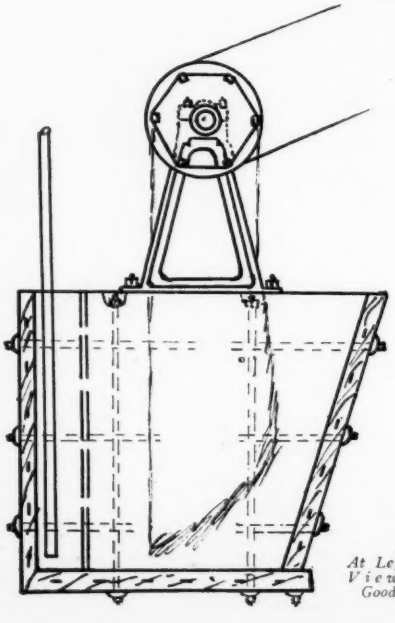

Fig. 8
At Left—Sectional View of Piece Goods Machine.

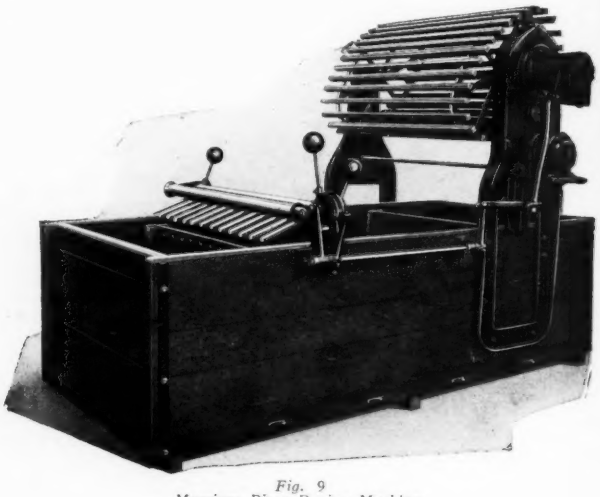

Fig. 9
Morrison Piece Dyeing Machine.

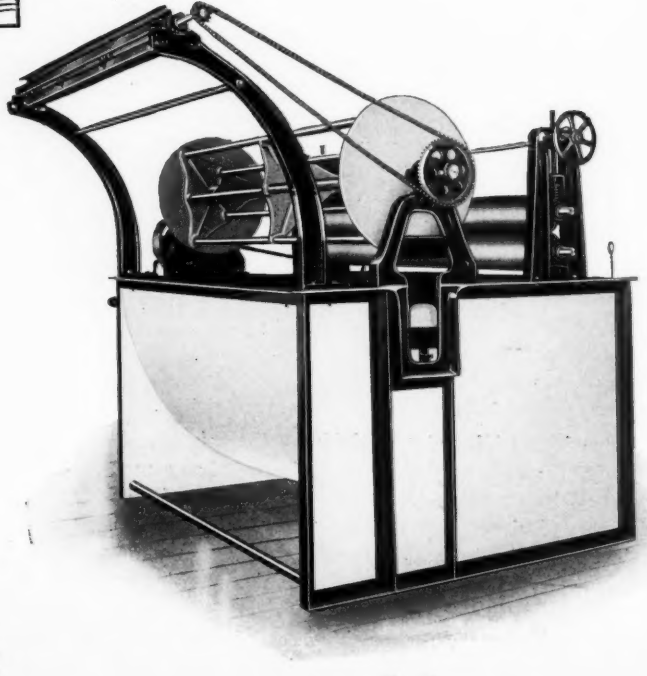

Fig. 10
James Hunter Piece Dye Kettle.

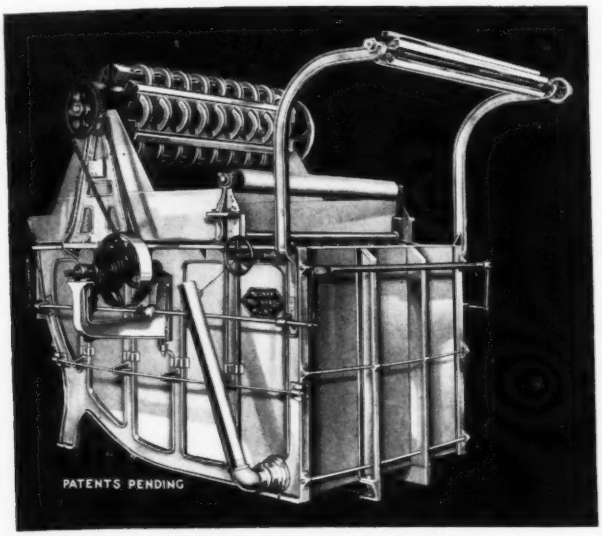

Fig. 11
Rodney-Hunt Piece Dye Kettle.

Fig. 13
Textile Finishing Machinery Co. Dye Jig.

Jigs and Padders

Special classes of dyeing brought forth many special developments in machines based upon the single basic principle of passing the material in a continuous form thru the dye solution, such as jigs and padders. These

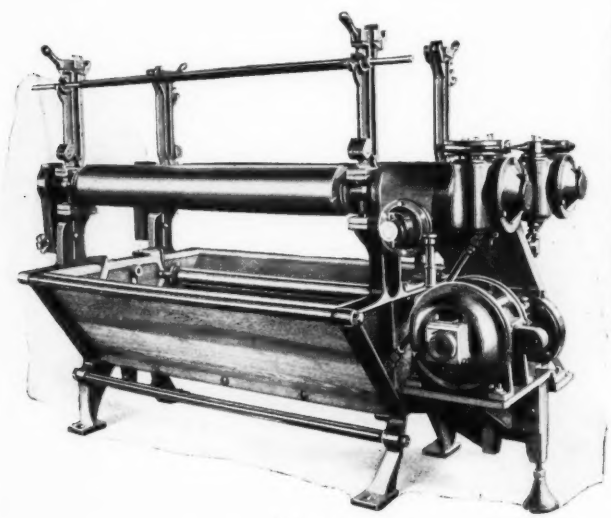

Fig. 12
Morrison Machine Co. Dye Jig

were for piece-goods, and the material was rewound from one roll to another passing thru the dye solution in the operation or the dye solution is carried to the cloth by the padding roll, as it passes thru the nip. Of this type of machine there are many on the market and a wide variation has been made by arrangement of rolls, vats, skying apparatus, and other essentials to meet the variety of conditions imposed by great variety of material treated. All weights of fabric are processed in this type

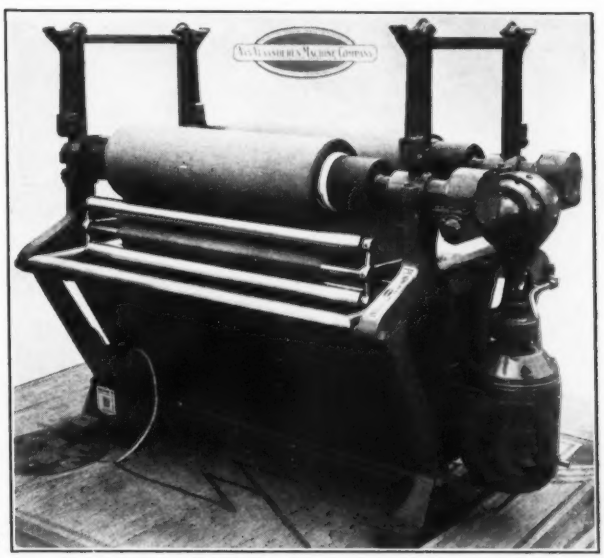

Fig. 14
Van Vlaanderen Machine Co. Jig.

of machine (adapted of course to material being processed) from light sheer weaves to heavy duck.

Dyeing of Warp Yarn

Another special branch of textile coloring of considerable importance is the dyeing of warp yarn in chain form. The machine most commonly made use of for this work consists of a shallow rectangular vat having at one end (delivery end) pressure rolls and a device for plaiting or coiling the chain as delivered. In the vat is a series of rolls so placed as to be staggered and also submerged. The chain is fed in over a tension bar and led over and under the rolls in the vat and finally passes thru the pressure rolls and is led over a creel or thru a

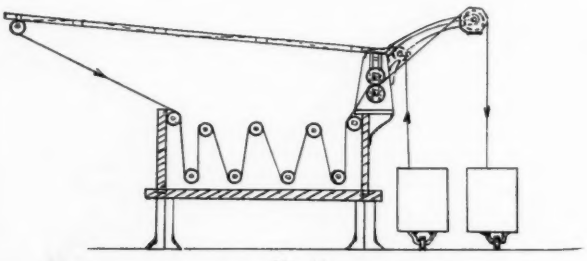

Fig. 15
Sectional View of a Common Type of Chain Warp Machine.

plaiting device. In its passage thru the machine (which time interval has been predetermined and the machine geared accordingly) the dyeing is accomplished, but it is

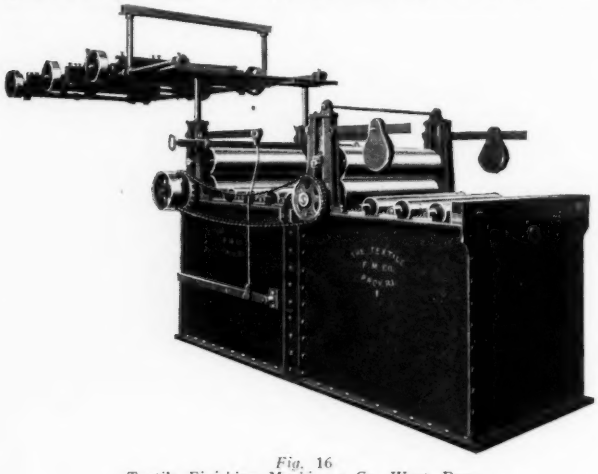

Fig. 16
Textile Finishing Machinery Co. Warp Dyer.

general to reverse the chain and run thru again, and on heavy shades as many as eight times. Rinsing is carried on in a similar machine reserved for the purpose, as it is common to maintain a standing bath for most colors.

The Scotch Tub

To meet the condition of a more concentrated bath (short bath) the so-called Scotch Tub was developed and

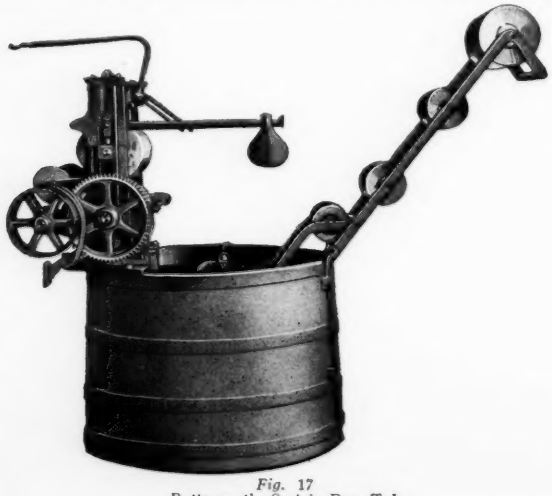

Fig. 17
Butterworth Scotch Dye Tub.

has been widely adopted. In operation it is very similar to the warp machine described.

Fig. 18
Textile Finishing Machinery Co. Scotch Dye Tub.

Continuous Warp Dyeing

Another type of machine used for this work, and, in fact, widely used, is the continuous or compartment machine which makes possible the completion of the process from wetting out, dyeing, after-treatment, rinsing, drying and even sizing in progressive movement through the machine without any rehandling or rerunning, whatsoever.

While the large variety of jigs, padders, chain warp, Scotch tubs, continuous or compartment machines are

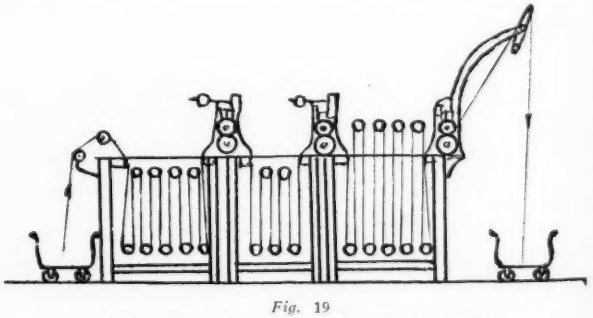

Fig. 19
Sectional View of Continuous Warp Dyeing Machine.

somewhat confusing, all are based upon the same principle of operation, namely, that the cloth or yarn is pulled forward through the dye solution at a predetermined rate of speed (interval for dyeing), and, while there may be some agitation, there is no real circulation of the bath.

(Continued on page 434)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Annual Meeting, Dec. 2 and 3.

* * *

Meeting, Piedmont Section, July 16.

* * *

OUTING, NORTHERN NEW ENGLAND SECTION

The Northern New England Section held its tenth annual outing at the Merrimack Valley Country Club on Friday, June tenth. Golf and tennis on the breezy hillside produced ninety-eight good appetites and some sizzling bald heads.

Golf prizes for members went to George Linberg for low gross of 82, to Gordon Thompson for low net, and to Phillips Graham for longest drive. Eric Goulaud was awarded a token of sympathy for gross of unmentionable dimensions. Of the guests Ray St. Clair took the prize for low gross with an 84, and Charles Simes the prize for net. In tennis Maurice Lewis took the singles prize; Eric Peterson and Eugene Bernat the doubles.

The outing was arranged by John Grady, committee chairman, Roland Derby, Clarence Nutting, and Walter Zillessen.

Officers elected for the ensuing year are Leverett N. Putnam, Chairman; Clarence L. Nutting, Secretary; John H. Grady, Treasurer; Roland E. Derby and Claxton Monro to serve with Stephen W. Bastow and William R. Moorhouse on the Sectional Committee; and William R. Moorhouse to represent the Section on the committee to nominate officers for the Association.

Respectfully submitted,

Harold C. Chapin, *Secretary.*

GLIMPSES
at the
Annual Outing
of the
Northern New England
Section
June 10, 1932

Proceedings of the American Association of Textile Chemists and Colorists

Some Observations on Light Fastness*

By JOSEPH W. RUSSELL

WHEN Mr. Bastow asked me to present a paper at this meeting, I recalled that more than a year ago I made an outline of a paper on light fastness which I intended to offer for publication in the American Dyestuff Reporter. Unfortunately, due to the rush of other things, the paper was never completed. The idea of writing such a paper was prompted by an article on "Abnormal Fading' by Mr. W. H. Cady, published in the American Dyestuff Reporter January 19, 1931. Mr. Bastow's invitation therefore serves two purposes. It enables me to be of some slight service to this section and at the same time present a few observations which may be of general interest.

During the past ten years there has been a decided change in the fastness requirements of dyed fabrics. In order to satisfy the requirements, mill laboratories have been obliged to test a large number of colors and at present have a considerable amount of information regarding the fastness properties of the various dyestuffs. Ten years ago the light fastness requirements were not particularly severe. Then followed a period during which fast direct dyes were suitable for most light fast requirements. During the past few years there has been a great demand for fabrics guaranteed fast to both light and washing. The trade is beginning to realize that a few cents a yard additional for fast colors is a worthwhile expenditure.

Unfortunately, during the past year or more there has been a tendency to take a step backwards as regards fastness. Competition has been very keen and prices low. Some manufacturers have felt obliged to substitute low-priced and less-fast colors. At the annual meeting last December, Dr. Killheffer mentioned this tendency and emphasized that in his opinion it was not good judgment. For several years previous to the present economic disturbance, the selection of colors was determined by the requirements the cloth would be expected to meet. Lately, the tendency has been to meet a price regardless of fastness. It is unfortunate that this lowering of standards has been forced upon us. If it continues it will destroy the consumer confidence which has been built up during the past few years by the concerted efforts of the Dyestuff Industry, our Association, and others of a similar nature.

Formerly it was the general practice, where only light fastness was required, to select a range of colors from the so-called Fast To Light Direct Colors regardless of shade or depth of color. It was soon found, however, that it was not possible to dye a complete range of shades of equal fastness with direct colors. For example, it is well known that a certain direct yellow possesses excellent fastness to light. It is not possible to dye a blue or green shade of equal fastness with direct colors.

The following is a suggested procedure for obtaining a range of fast to light shades of approximately equal fastness.

Sulphur Black is suitable for all Fast to Light requirements. It is much cheaper than the Fast Direct Blacks, a more desirable shade, and decidedly faster.

In dyeing blue shades the depth will determine the type of color which can be used. Light shades of direct blue do not possess good fastness to light, while for heavy shades it is possible to select direct colors of suitable fastness. It is good judgment to dye all light and medium blues with Indanthrene colors, and the heavy shades with direct colors.

Heavy brown shades of moderate fastness can be obtained with direct colors or with carefully selected sulphur colors when the shade can be obtained. There are some sulphur browns which when aftertreated are faster to light than direct colors. A combination of a sulphur dark brown with sulphur tans, aftertreated, will give a considerable range of shades which will be faster than the same shades dyed with direct colors. For very light shades such as tan, drab, etc., Indanthrene colors should be used.

The direct greens are not of as good fastness as some of the other direct colors, although there are a few of moderate fastness. Experience has shown that Indanthrene colors should be used for the lighter shades, while the heavier shades can be obtained by the use of carefully selected direct colors or certain sulphur greens in com-

*Presented at May Meeting, Northern New England Section, May 7, 1932.

bination with a direct yellow and aftertreated. In cases where it seems desirable or is necessary on account of cost to use direct colors, care should be used in the choice of colors. Many green shades are dyed with blue and yellow. The use of an extremely fast yellow is not good judgment as the blue will fade out first, resulting in a decided change in shade. A yellow should be selected which has approximately the same fastness as the blue. The fading will then be more a change of depth than a change of shade.

There are several direct oranges in both the yellow and red shades which possess very good light fastness and are suitable for the majority of fabrics calling only for fastness to light.

For heavy red shades there are available direct colors of good fastness. For the lighter shades such as pink, the direct colors are not suitable and Indanthrene colors should be used.

For yellow the well known direct yellow mentioned above can be shaded with a direct orange to give a range of yellows of very good fastness.

The number of direct violets of sufficiently good light fastness is very small. There are, however, a few of extremely good fastness. It is possible to select two violets, one a red shade and one a blue shade, which can be used to dye a wide range of shades of very good fastness.

By following the above procedure it is possible to dye a range of sunfast shades in which there will not be any weak link. Obviously, the pattern is only as good as the poorest color in it.

In dyeing shades to be guaranteed fast to sun and washing it is necessary to use great care in the selection of colors, also in their application. In selecting colors for combination shades the use of colors which do not fade uniformly should be avoided. It has been generally known for a number of years that some colors which do not possess good fastness to light as self shades, produce shades of comparatively good fastness when dyed in combination with another color. The outstanding example is Anthraflavone. Dyed alone its fastness to light is poor. However, when dyed in combination with Indanthrane Blue G C D the resulting green has good relatively fastness to light. Until recently the mistake was commonly made of assuming that colors which were fast as self shades would be fast when dyed in combination.

During the past few years we have investigated the fastness to light of hundreds of colors. This investigation covered at the start the so-called Sunfast Direct Colors, which were shortly replaced to a large extent by vat colors. The tests on the vat colors have included all colors for which any appreciable degree of fastness was claimed by the manufacturers. Incidentally, at the same time weather tests of the same colors were made. A comparison of light fastness and weather fastness gave some very interesting results. This is, however, a subject in itself which does not apply to this paper.

It may be of interest to digress here long enough to explain the procedure which is followed in making a light test. I have always felt that the only accurate and dependable way to make a light fastness test is by actual exposure to the sun. In order to keep the samples clean and dry the exposures are of necessity made under glass. The exposure frame consists of a wooden box about three inches deep with the glass cover hinged on two blocks on one side and shutting against two blocks on the other side in order to allow free access of air. The frame is attached to the southern wall of a building at an angle of 45° in a position which allows it to be exposed to all of the sunlight from early morning until three o'clock in the afternoon. No attempt has been made to measure the degree of fastness of colors except by comparison with colors known to be of suitable fastness. Every color is exposed against a color of known fastness and tests are examined at intervals of ten days, and continued until it is definitely established whether there is a difference in fastness. In this manner it is possible to establish a very definite record of fastness of all colors tested in comparison with colors previously established as standards. Records are kept with the following comments regarding the colors with a note showing the behavior of the standard color during the same exposure. The degrees of fading are measured as, "No Change," "Slightly Faded," "Considerably Faded," "Badly Faded," and "Color all Gone." When following this procedure it is not necessary to keep a record of the number of hours of sunlight, nor are the tests appreciably influenced by the season, except that they will, of course, be run longer during the fall and spring than in the summer. Regardless of the season or the length of exposure there is always a record of the fastness in comparison with a color which has been adopted as standard.

The first abnormal fading that came to my attention was about two years ago in certain brown shades which were dyed with Indanthrene Brown R, Blue G C D, and other colors used in smaller amounts. It was noticed that there was a decided change in tone after severe exposure. In order to determine which of the colors was at fault all possible combinations were made of the colors in question, and light tests made. It was seen from these tests that any combination in which Brown R and Blue G C D occurred became redder on severe exposure to sunlight. Mr. W. H. Cady made reference to the same observation in his paper, "Abnormal Fading" published in the American Dyestuff Reporter, January 19, 1931.

Following the above observation it was felt that it would be interesting to test other combinations. A few colors of varying fastness were selected and all possible two color combinations dyeings were made.

In order to obtain information in a comparatively short time the dyeings were made in light shades and were Laboratory dyeings. When dyeing a color with a low dyeing temperature in combination with one with a high dyeing temperature the average temperature is used. The dyeings were all developed by a treatment with boiling soap.

It may be well at this point to give a brief summary of investigations of dyeing temperature and various developing treatments for Indanthrene colors.

Several typical Indanthrene colors have been dyed at temperatures ranging from 100-160°F without in any way affecting the fastness of the colors or the depth of shade, provided all other conditions are correct. Occasionally a somewhat better exhaustion results from the higher temperatures than with the lower temperatures. In view of these investigations an average temperature is always used, when dyeing two colors of different dyeing temperatures.

While it has been generally agreed that a thorough soaping is necessary to obtain the maximum fastness of a vat color the value of Acetic Acid has been questionable. In order to demonstrate whether or not it is necessary, experiments were run on a large number of colors. Several skeins were dyed in the same bath and washed together. The skeins were then treated separately, as follows: no treatment after washing; soured with Acetic Acid; soured with Acetic Acid followed by soaping. The time of soaping was varied as follows: 1, 5, 10, 20, 30, and 45 minutes. Light tests were made of all these dyeings and showed that Acetic Acid has no influence on the light fastness. The tests also demonstrated very clearly that thorough treatment with boiling soap is necessary to obtain the maximum fastness. The samples soaped one minute were not nearly as fast as those soaped thirty minutes and there is a gradual increase in fastness as the time of soaping is increased from one minute to thirty minutes.

The following colors were dyed in all possible two color combinations. I have purposely omitted the trade names of the colors but I am sure you will recognize them as well known colors of the Indanthrene type.

Color	*Fastness and Nature of Fading*
Brown G	Excellent, practically no change.
Brown R	Excellent, practically no change.
Jade Green	Good, slight change.
Grey R R H	Excellent, practically no change.
Orange R K	Good, shade is slightly thinner.
Orange R R T	Fair, considerable change in depth and tone.
Red B N	Excellent, very little change.
Scarlet R	Good, shade is somewhat thinner and bluer.
Violet B N	Good, shade is somewhat thinner and bluer.
Violet R R N X	Good, shade is slightly thinner.
Anthraflavone	Poor, much thinner and decided change in shade.
Yellow G	Poor, shade is thinner and decidedly olive in tone.
Blue G C D	Excellent, practically no change.
Blue 3 G	Excellent, practically no change.
Blue R C X	Excellent, practically no change.

The samples were exposed to light from August 15 to November 13, 1930. The exposures were made out of doors, under glass, in the same manner previously described. To some this may seem an unreasonably long exposure, but it must be kept in mind that we are dealing with fast colors and are looking for results which would be expected under extreme conditions. The majority of fabrics such as draperies, furniture coverings, etc., which would justify the cost of Indanthrene colors, would be obliged to withstand a very long exposure, probably more sunlight than the samples in question received. I refer to those cases in which furniture and draperies are not protected from the sun by window shades. In the past we have tested several series of dyeings inside of a window on the south side of a building and in the exposure frames outside at the same time. As a result of these tests I believe that it would require two to two and one-half times as long to fade inside of the window as in the exposure frame. This would be rather difficult to determine exactly as the two exposures would necessarily be made at different times. The samples which are outside are tested for a given period of time and the indoor ones started at the same time. The outside exposures are taken in when they are appreciably faded and the indoor are taken down when the degree of fading is the same as the outside ones. This means that if the exposures are started in the Spring, the inside ones receive more intense sunlight as the test continues or if they are started in the middle of the Summer, they receive light of decreasing intensity as the test proceeds.

Following is a table showing the classification we have given to the fastness of the various combinations. We have graded them "Excellent" "Good," "Fair," and "Poor," these being abbreviated to "E," "G," "F," and "P" in the table. "Excellent" means no fading or very slight fading; "Good" indicates a slight decrease in depth with or without a slight change in shade; "Fair" and "Poor" indicate increasing fading of depth or shade, or both.

The long exposure naturally results in some cases in a lower classification than is normally attached to the colors. Colors which you have known as very good or excellent you will find classified as good or possibly poor. Therefore I hope you will not lose sight of the fact that the exposure was intentionally severe in order to determine relative fastness under extreme conditions.

TABLE SHOWING FASTNESS OF COMBINATION DYEINGS

Light Exposure August 15 to November 13, 1930

	Fastness Alone	Brown G	Brown R	Jade Green	Grey RRH	Orange RK	Orange RRT	Red BN	Scarlet R	Violet BN	Violet RRNX	Anthraflavone	Yellow G	Blue GCD	Blue RCX	Blue 3G
Fastness Alone	E	E	G	G	E	G	P	E	G	G	E	P	P	E	E	E
Brown G	E		E	P	E	E	G	E	G	G	E	P	F	G	G	G
Brown R	G	E		P	G	G	F	E	G	F	G	P	F	F	F	P
Jade Green	G	P	P		E	G	P	P	G	E	G	P	P	E	E	E
Grey RRH	E	E	G	E		E	E	E	E	E	E	G	G	E	E	E
Orange RK	G	E	G	G	E		G	E	G	E	G	F	F	E	E	E
Orange RRT	P	G	F	P	E	G		E	G	G	G	P	F	E	E	G
Red BN	E	E	E	P	E	E	E		E	E	E	G	F	E	E	G
Scarlet R	G	G	G	G	E	G	G	E		E	E	F	F	E	E	E
Violet BN	G	G	F	E	E	E	G	E	E		E	P	G	E	E	E
Violet RRNX	E	E	G	G	E	G	G	E	E	E		P	F	E	E	E
Anthraflavone	P	P	P	P	G	F	P	G	F	P	P		P	F	F	F
Yellow G	P	F	F	P	G	F	F	F	F	G	F	P		E	E	G
Blue GCD	E	G	F	E	E	E	E	E	E	E	E	F	E			
Blue RCX	E	G	F	E	E	E	E	E	E	E	E	F	E			
Blue 3G	E	G	P	E	E	E	E	G	E	E	E	F	G			

Since the table does not show the manner in which the various combinations faded, a brief description will probably be of interest.

BROWN G. In combination with Jade Green, Blue RCX, Blue GCD, Blue 3G, Anthraflavone, and Yellow G, the fading is abnormal. The shades become much redder on fading, the Blues, Green, and Yellow having largely disappeared.

BROWN R. The same colors which show abnormal fading with Brown G show the same result in combination with Brown R to a greater degree.

JADE GREEN. This color fades abnormally in combination with Brown G, Brown R, Yellow G, Anthraflavone, Orange RRT, and Red BN, the Green disappearing to a large extent on exposure.

GREY RRH. None of the combinations in which this color is used show abnormal fading. In every instance the fastness of the combination is equal to the fastness of the individual colors. Anthraflavone and Yellow G are faster in combination with Grey RRH than they are alone.

ORANGE RK. All combinations are equal to or better than individual colors.

ORANGE RRT. The only abnormal fading is the combination with Jade Green mentioned above. It will be noticed that while Orange RRT is rated as poor alone, it is of excellent fastness in combination with the Blues.

RED BN. The only abnormal fading is the combination with Jade Green.

SCARLET R. There are no abnormal fadings in the combinations with this color.

VIOLET BNX. None of the colors show abnormal fading in combination with this color.

VIOLET RRNX. There are no abnormal fadings in this group.

ANTHRAFLAVONE. None of the colors in this group are of particularly good fastness. On a shorter exposure the combination of Anthraflavone with the Blues has moderate fastness, which, however, is not so good on a longer exposure.

YELLOW G. This color is in all cases faster in combination than it is alone. The combination with Anthraflavone is the only one in which the tendency to become olive is seen. As stated above, the combination with Jade Green is not satisfactory, the Green fading more than the Yellow.

BLUE GCD, BLUE RCX, BLUE 3G. There are no abnormal fadings in combinations of the Blues with the other colors except with Brown G and Brown R mentioned previously.

It will be seen that there are 16 two color combinations in which the fading is abnormal, one of the colors largely or entirely disappearing in each case. Since the colors used in the tests were a fairly representative group, it seems reasonable to assume that in any group selected there might be some cases of abnormal fading. If maximum light fastness is desired, severe light tests should be made of all combinations before adopting them. It is possible that a combination which seemed to be satisfactory after a short test have very poor fastness if given a test severe enough to be comparable with the exposure the cloth would receive in actual use.

My main reason in presenting a paper of this type is to bring before you the desirability of establishing a maximum standard of fastness and to suggest precautions which are necessary if the standard is to be attained. If it stimulates some interest in further investigations of the same nature, I shall feel that it has served its purpose.

Discussion

Mr. Grimes: That is a very excellent and comprehensive paper. I am sure many of you are looking forward to seeing it in print. I wonder if there are any questions to ask Mr. Russell.

Mr. Moorhouse: I'd like to ask about the grey he spoke about. Isn't it a mixture in itself?

Mr. Russell: Yes, it is a mixture.

Mr. Durfee: May I ask what is the greatest objection to using a sulphur black bottom in combination with other colors? For example, if you wish an ice khaki, if you happen to be redyeing sulphur black, then add a yellow or some other thing it is generally objectionable.

Mr. Russell: I have never had occasion to do that. I think it is taken for granted that there is a possibility of tendering if you redye sulphur black.

Mr. Durfee: I am a little curious to know what has become of two or three antique things, aniline black, etc.

Mr. Russell: They are out of the picture.

Mr. Durfee: Aren't they any good?

Mr. Russell: The application is somewhat complicated. Aniline Black has been largely replaced by Indanthrene Black. The cost of Indanthrene Black has been lowered to the point where it is more economical to dye than Aniline Black.

Mr. Moorhouse: You were speaking of yarn dyeing?

Mr. Russell: Yes, my statements apply to Yarn Dyeing only. Aniline Black still is largely used on piece goods.

Mr. Grimes: In those colors which you rate as excellent, how long an exposure would have been necessary to fade them?

Mr. Russell: That is rather difficult to answer. Those samples had three months exposure in the fall. Had we started them in June and exposed them three months in the summer, there would have been an appreciable fading even in those colors classified as excellent.

Mr. Grady: Would you say there would be any difference in fastness to light of the same colors dyed on yarn and on stock?

Mr. Russell: The stock dyed color would be faster on account of better penetration of color. I am speaking of stock dyeing in comparison with chain dyeing. If the yarn were package dyed, the fastness would be equal to the stock dyed color.

Mr. Stewart: On the fastness, your ideal way was sunlight exposure. Taking the direct colors and vat colors, do you find much difference between the sunlight and the lamp?

Mr. Russell: We have never made a direct comparison. We test some of our fabrics with the Fade-Ometer because a few of our customers use the Fade-Ometer in testing and we wish our tests to be comparative with theirs.

Mr. Stewart: I have heard it mentioned that the Fade-Ometer is not always comparative to the sunlight.

Mr. Russell: I suspect that it isn't.

Mr. Stewart: I wonder if it might apply to one type more than another.

Mr. Russell: We are planning to tabulate the results of a large number of tests recently made and hope to be able to answer that question at a later date.

Mr. Zillesson: We have tried experiments along that line and find the difference between the Fade-Ometer and sunlight showed more on wool colors than they did on vats.

Mr. Russell: I think there is a possibility that the fading in a Fade-Ometer is not as uniform. After you approach a certain degree of fading, it would be faster in the Fade-Ometer than it would be in the sunlight. You might get a different comparison with the different lengths of exposure.

Mr. Zillesson: We checked our Fade-Ometer against the sunlight with vat colors. They checked pretty well. The percentage of fading based on the hours of sunlight in the Fade-Ometer showed practically the same with the exception of some wool colors.

Mr. Moorhouse: There is an abnormal fading on Red BN. There are abnormalities on some vat colors and also some direct colors. A Pink dyed with Red BN will fade rather quickly on the Fade-Ometer and it is considered a fast color.

Mr. Grimes: Mr. John Dalton of the Worsted Division of the Pacific Mills is our next speaker. Let me say that the speakers tonight are both fellow members of our section.

OUTING, NEW YORK SECTION

The Annual Outing of the New York Section was held on Thursday, June 23rd, at the Elmwood Country Club, in East Paterson, New Jersey. Prizes were awarded at golf as follows: Low gross, P. A. Dunkel; low net, E. V. Paterson; low score for guests, Bert Allen (decided by lot). The winners in the horseshoe tournament were Faulkner and Staat. A set of horseshoes was awarded as a prize.

Following the dinner in the evening, Chairman Herrmann announced George L. Baxter as chairman of the program committee for the coming season. The other committees are to remain the same as for the past season.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

A. NEWTON GRAVES,
Franklin Process Co.,
Providence, R. I.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

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Volume XXI July 4, 1932 No. 14

RAYON PRICE CUT

PRICE reductions made recently by leading domestic producers of rayon yarn—the second series of cuts in less than a month—bring 150 denier viscose process knitting cones of first quality down to 55 cents a pound. Chardonize 150 denier cones, which until recently had been listed at 83 cents, are now quoted at 65 cents. At least one company is quoting 75 cents a pound on 150 denier acetate yarn.

These prices, the lowest ever recorded on domestic rayon yarn in this country, have been brought about by a combination of circumstances. Some of the causes are obscure and can only be guessed at by the ordinary observer. It is plain, however, that a proposed policy of curtailing production severely to consumptive requirements contemplated only a month and a half ago, with no change in price lists, has given way to unusually severe price competition among producers.

It may be and is argued by some that current prices are down where they belong; on the other hand, it is believed by others that the new price levels do not enable producers to make a fair profit. Producers of the only man-made yarn in the textile industry, with absolute control over their own production, may have joined the ranks of other branches of the textile industry which, by and large, are operating without profit. If they have, we do not believe there is any reason for gloating over the fact by yarn consumers. Consumers have seldom, if ever, obtained any advantage by reason of a reduction in rayon yarn prices, and there is little reason to believe they will do so now.

It is felt by many that the prices now in effect represent about the bottom for rayon. At the same time there is always the possibility that they do not, especially if larger producers are engaged in an attempt to eliminate from the field some of the smaller producers, as is reported.

Not a few conservative men in the knit goods trade had hoped that the rayon yarn industry would adopt a firm price policy in preference to one of price cutting and are genuinely disappointed that their hopes have not been realized.

SOMETHING DIFFERENT

IN an unusual and exceptionally able and vigorous statement of policy, the Aberfoyle Manufacturing Co., largest domestic yarn mercerizer, announced recently that it will advance its prices on July 15, provided the demand for its product does not increase. The advance, it states, will be on the basis of 5 cents a pound on 60/2 combed peeler Durene cones, with other numbers in proportion. This step will be taken in the hope and belief "that it will serve to prevent any further decline in the living standards of our employes."

It has been recognized for some time that an upturn in the severe business depression which has gripped this country for nearly three years—and other countries for longer periods—would be signalized by a rise in commodity prices. From this standpoint, as well as from others, it will be hoped by many in the trade that the Aberfoyle company announcement indicates a general stiffening in cotton yarn prices, helped by an upturn in raw cotton. The stage is apparently, if artificially, set for an advance in raw silk; rayon producers have it within their own power to stabilize their prices; raw wool appears to be scraping bottom.

The Aberfoyle statement concludes with these words: "We believe this or other similar measures looking to the restoration of market confidence are essential and they should be effected promptly throughout the industry."

The company's announcement is unique in clarity and broad visioned conception. We quote:

"After a careful study of the situation in which the textile trade in general and the durene trade in particular now finds itself, due to business conditions in this country and abroad, we are of the opinion that we must establish a definite policy to offset the present shrinkage of demand for textile fibres and fabrics. At this time not only is yarn sold below the present cost of production of the lowest cost mills on a normal operating schedule, but the losses sustained are immeasurably increased by the curtailment that goes on in production as the depression drags along.

"It is easily seen that in the main the burden of these distressing times falls upon industry's employes. Every textile manufacturing concern in this country has looked to economies as never before; wages in many quarters have been lowered to a point where those who are employed find their meagre incomes ineffectual in their efforts to live under half-way satisfactory conditions; other items of the cost of production have been cut to an ir-

reducible minimum; and still the price war goes on, with disastrous results to the companies so engaged, to the employes in particular and to the community at large. Continued price decline below the cost of production is bound to mean not only a definite lowering of quality standards but a continued reduction in purchasing power and a prolongation of the depression. . . . .

"We have been continuous employers of American labor and skilled operatives for over fifty years, and we realize at this time more than ever our duty to our many loyal employes and the absolute necessity of continuing to employ as many people as we possibly can, as many hours a week as our production costs and selling prices permit. . . . We see no advantage in the scurry for orders in a market where demand is lessening weekly. Such procedure, resulting in price cutting, secures no additional poundage and forces further wage reductions and other measures that are not justified.

"It is interesting to note here the opinion of the knitting trade and the buyers of the product of the knitting mills on the price trend of yarns. We have found that both the knitters and the buyers of the product of the knitting mills, such as chain stores and the jobbers, etc., have expressed themselves as deploring the continuous decline in prices, and in many instances they have honestly wished for a substantial advance in the prices of the basic commodities that they use, such as durene yarn, silk and rayon."

Sooner or later they will get it; perhaps sooner than many now anticipate.

Chemical Unemployment Committee

The Chemical Unemployment Committee, 300 Madison Ave., New York City, report they have 30 unemployed chemists and chemical engineers registered who have had one or more years of direct experience in the Textile Industry. The experience includes the following—colors, bleaches, dyeing, cotton, rayon, silk, wool, finishing, research in the hat industry, washing reagents and testing.

This presents an opportunity for the industry to obtain experienced, technically trained men that are not ordinarily available.

Since the first of the year the committee has registered six hundred and eight chemists and chemical engineers living within a radius of fifty miles of New York City and has located jobs for 130.

This is a cooperative committee and is sponsored by:
American Chemical Society.
(New York Section and North Jersey Section.)
American Institute of Chemists.
American Institute of Chemical Engineers.
American Electrochemical Society.
Association of Consulting Chemists and Chemical Engineers, Inc.
Societe De Chemie Industrielle (American Section).
Society of Chemical Industry (American Section).
Technical Association of Pulp and Paper Industry.
American Gas Association.
Compressed Gas Manufacturers Association.

Announcement

The American Cyanamid Company has announced that, effective July 1, 1932, American Cyanamid & Chemical Corporation, a wholly owned subsidiary, consolidated the activities formerly carried on by the following subsidiaries:

American Cyanamid Sales Company, The Kalbfleisch Corporation, A. Klipstein & Co., Inc., Klabfleisch Bauxite Co., Inc., Fumigators Supply Company, Superior Chemical Co., Inc., John C. Wiarda & Co., Inc.

At the same time the activities of American Cyanamid Company in industrial and heavy chemicals will be merged with those of American Cyanamid & Chemical Corporation. American Cyanamid Company will continue to handle fertilizer materials and mining chemicals as in the past.

In addition to the above, the activities of the following companies will at the same time be placed under the control of American Cyanamid & Chemical Corporation:

American Powder Company, The Selden Company, Structural Gypsum Corporation, Owl Fumigating Corporation, The Klabfleisch Corporation of Surinam (Dutch Guiana).

German Coal-Tar Product Situation Summarized

The 6,000,000 tons of stocks held on hand by the German coke industry led to curtailed output, with tar and pitch production falling to such a low level that some doubt is expressed as to its ability to make its usual exports to European markets. This is expected to improve the demand for American pitch in the markets. The German market for road tar has become more highly competitive, creosote oil demand has fallen sharply, but exports of naphthalene are fairly stable. Anthracine residues and benzol are also adversely affected by conditions, but cresol is selling fairly well.—*Trade Commissioner William T. Daugherty, Berlin.*

Rezyls

The American Cyanamid Company has recently issued the second edition of their booklet on Rezyls and Teglac, for surface coatings and miscellaneous applications.

A copy of this booklet will be sent upon request to anyone interested.

The Detection and Determination of Small Quantities of Metals in Textile Materials

(Continued from page 417)

Delicate Test for Aluminium

Kolthoff (*Chem. Week Blad.*, 1927, 24, 447) found that 1:2:5:8 hydroxyanthraquinone is a delicate reagent for aluminium. 10 c.c. of the solution to be examined are adjusted to pH 5.6 and treated with 0.2 to 0.3 c.c. of a 0.1 per cent. solution of the dyestuff. On warming the mixture to 50 deg. C., or allowing it to stand for half an hour a violet lake is formed in presence of aluminium. Iron, copper, tin, antimony and bismuth must be absent. Copper may be rendered inert by treatment with sodium thiosulphate, tin, antimony and bismuth by adding Rochelle salt or sodium tartrate.

Zinc.—A delicate test for zinc is that of Cone and Cady (*Analyst*, 1927, 730). The solution to be tested is boiled with ammonia and ammonium chloride, to precipitate iron and aluminium, and filtered. The filtrate is acidified with acetic acid and tested for zinc by adding 5 drops of a solution of 1 grm. of diphenylamine in 100 c.c. of glacial acetic acid and 5 c.c. of a 5 per cent. solution of potassium ferricyanide. An immediate appearance of a dark brown, green or purplish-black turbidity indicates the presence of zinc. The test may be applied to spots on fabrics by treating them successively with the diphenylamine and ferricyanide solutions.

Use of Oxyquinoline

Aluminium, Magnesium and Zinc are precipitated by oxyquinoline giving compounds; in the case of magnesium, it has the formula $Mg(C_9H_6ON)_2 4H_2O$. A 5 per cent. solution (Hahn and Bieweg, *Z. Anal. Chem.*, 1927, 71, 122) in alcohol is used. The solution to be tested, which may be faintly acid or neutral, is warmed and treated with the reagent, together with a little more ammonium acetate than is required to react with the free and liberated mineral acid. In the case of magnesium and beryllium a moderate excess of ammonia must be present. The precipitates formed are allowed to stand for some time on the water bath and then cooled. They are collected on glass or porcelain and washed with N/5 acetic acid, then with weaker acetic acid, and finally with water. Dilute ammonia is used in the case of magnesium and beryllium. The precipitate is then dried first at 100 deg. to 120 deg., then to constant weight at 140 deg. to 160 deg. C. The method is very accurate for magnesium. Zinc may be precipitated in either ammoniacal or acid acetate solution. In presence of magnesium, zinc is first precipitated from the acetate solution; the filtrate is then treated with ammonia and more of the reagent to precipitate the magnesium.

Manganese.—A very delicate test for manganese consists of converting it into ammonium permanganate by treatment with ammonium persulphate in presence of silver oxide, which acts as an oxygen carrier. The solution is acidified with sulphuric acid and sufficient silver nitrate added to leave an excess of silver after all the chlorides have been precipitated. Pure ammonium persulphate is than added and the mixture boiled. Even minute traces of manganese produce the characteristic color of permanganate. The quantity of manganese present can be determined colorimetrically by matching the color with a standard solution of potassium permanganate. When a solution containing manganese is treated with benzidine acetate dissolved in dilute acetic acid, a bright blue color is produced.

Tracing Tin

Tin.—Traces of tin may be identified from the fact that when in the stannous condition they change the yellow color of a dilute solution of cacotheline (a nitration product of brucine) to brown violet.

When present on fabrics, the method of Davies (*Analyst*, 1932, 95) may be applied. The material is moistened with water on a watch glass and a drop of a 0.5 per cent. solution of ammonium molybdate in N hydrochloric acid is applied, followed by a drop of a 5 per cent. solution of sodium phosphate. In presence of tin in the stannous condition, a blue color is produced.

The best method is that of Buchanan and Schryver (*Analyst*, 1909, 121). The organic matter is destroyed by means of sulphuric acid, by heating in a large round flask until a colorless solution is obtained. The colorless liquid is cooled, diluted with water to about 600 c.c., saturated with sulphuretted hydrogen and allowed to stand overnight.

The precipitate of sulphide and sulphur is collected on a filter, washed with water and the tin estimated colorimetrically by the following process:—The filter and precipitate is transferred to a wide test tube and boiled with 5 c.c. of concentrated hydrochloric acid. It is then closed with a cork carrying a tube, and the air is displaced with carbon dioxide. A small piece of zinc foil is added to the hot liquid and as soon as this has dissolved 2 c.c. of the reagent (described below) are added, the current of carbon dioxide being continued. After boiling for a few minutes the solution is diluted to 100 c.c. with cold water, filtered, and the filtrate treated with a drop of dilute ferric chloride solution. A violet color is produced

(Continued on page 433)

The Application of the Stick Antimony Electrode to the Measurement of the pH of Dye Baths

By **L. R. PARKS and H. C. BEARD**
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In the measurement of the pH of dye baths with the stick antimony electrode it is essential that the dye bath must have normal air equilibrium at 25° C. if the electrodes have been calibrated in solutions having this equilibrium condition. This air equilibrium may be obtained for a freshly boiled solution by bubbling CO_2-free air through the dye solution while it is being cooled to 25° C.

IN A study of the dyeing process the authors realize the importance of pH control of the dye solutions, before and after dyeing. It was found impossible to obtain the correct hydrogen-ion concentration of dye baths, either those in true solution of colloidal, by the use of the hydrogen or the quinhydrone electrodes. With the hydrogen electrode the platinized platinum is rapidly covered and poisoned with the dye while with the quinhydrone electrode there is a chemical action between the dyestuff and the quinhydrone. Glass electrodes have been used for determination of the pH of dye baths[1] but they are delicate to handle and must be calibrated often for accurate results. The authors have found that the stick antimony electrode in use with the saturated calomel electrode gives very satisfactory, accurate and reproducible results in the determination of the hydrogen-ion concentration of dye baths.

The preparation and calibration of the stick antimony electrode has been given in a previous paper[2]. As the stick antimony electrode was calibrated with buffer solutions which were in normal equilibrium with the air it is evident that any solution which is to be measured must have this same normal air equilibrium.

A freshly boiled solution does not possess normal air equilibrium. As the process of dyeing takes place at the boiling temperature it was necessary to find a method of obtaining a normal air equilibrium on cooling the solution. Experimentally it has been found satisfactory to take the boiling solution and cool to 25°C. by bubbling a current of CO_2-free air through it and by running cold water over the container at the same time. The CO_2-free air was obtained by bubbling air through concentrated sodium hydroxide solution, very dilute sulfuric acid solution and water before entering the solution to be measured. It is absolutely essential that the antimony electrode not be in the solution while it is being saturated with air. When the solution has attained normal air equilibrium at 25°C. it is then ready for measurement and it is put into the cell with the saturated calomel electrode. The stick antimony electrode is then polished with emery paper, wiped with a clean cloth, rinsed with distilled water, put into the cell and readings taken.

With dry solutions it was found convenient to use a volume of 25 c.c. of solution for the measurement of pH. For this quantity of solution it has been found experimentally that 10 minutes cooling with the bubbling of CO_2-free air through the solution gives a normal air equilibrium. Table I gives the results obtained with water, a typical buffer solution and a dyestuff. The buffer solution was composed of KH_2PO_4 and $NaOH$[3], and the dyestuff was metanil yellow with a concentration of 100 mgs. of dye in 250 c.c. of water solution. For each determination a fresh solution was used. The pH of the solutions were calculated from the equation: $E = 0.007 + 0.05915$ pH.

TABLE I

Effect of time of air passage through solution to obtain normal air equilibrium and reproducible pH.

Water	Time of Air	E.M.F.	pH
Boiled and cooled to 25°C.	No air	0.3492	6.03
	5 mins.	.3168	5.48
	10 mins.	.3170	5.48
	15 mins.	.3168	5.48
Buffer Solution At 25°C.		0.3892	6.70
		.3907	6.73
Boiled and cooled to 25°C.	No air	.4242	7.30
	5 mins.	.3896	6.71
	10 mins.	.3903	6.72
	10 mins.	.3898	6.71
	15 mins.	.3903	6.72
Dyestuff Solution Boiled and cooled to 25°C.	5 mins.	0.3185	5.51
	10 mins.	.3277	5.66
	10 mins.	.3275	5.66
	15 mins.	.3245	5.60

This table shows that the bubbling of CO_2-free air through water and buffer solution establishes air equilibrium in five minutes but more satisfactory equilibrium conditions are probably obtained in 10 minutes. The pH values obtained for water are in agreement with the values found by previous investigators using other methods[4, 5, 6]. The pH of water will vary from 5.2 to 5.8 de-

pending on the source of supply and atmospheric conditions[4]. The table shows that equilibrium has also been reached with the dye solution in this time. Continued passage of air through the solution apparently causes some excess oxygen to be dissolved. In allowing a hot freshly boiled solution to cool to 25°C. air equilibrium is not obtained for several hours and even then the results are not to be depended upon.

Table II gives the results of the pH determinations of dye solutions made up at different times, sometimes months apart. It shows the absolute reproducibility of pH measurements with the use of the stick antimony electrode.

TABLE II

pH Determinations of Dye Solutions with the Stick Antimony Electrode

Dyestuff Solution	pH Values		
Metanil Yellow Dye	5.71	5.77	5.74
Metanil Yellow with NaOH	6.21	6.24	6.23
Metanil Yellow with Na_2SO_4	5.84	5.87	5.85
Methylene Blue with NaCl	4.06	4.07	4.06
Congo Red Dye	6.00	5.98	6.00

The results show that it is easy to obtain reproducible pH values to within 0.03 pH with the solutions of the same dye and salt concentrations made up and used at different times. The value of pH control in the dyeing process cannot be over estimated.

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[3] Clark, "The Determination of Hydrogen Ions," Williams and Wilkins, Baltimore, Md., 1928, 3rd Ed.
[4] Kendall, J. Am. Chem. Soc., *38*, 2480, (1916).
[5] Acres and Fawcett, Ind. Eng. Chem., Anal. Ed., *2*, 78, (1930).
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THE DETECTION AND DETERMINATION OF SMALL QUANTITIES OF METALS IN TEXTILE MATERIALS

(Continued from page 431)

which can be matched with known quantities of tin.

The reagent used is prepared as follows: Ten parts of nitric acid (sp. gr. 1.48) are mixed with an equal weight of nitric acid of specific gravity 1.40; the mixture cooled with ice and small quantities of thiodiphenylamine are added with continual stirring until 1 part by weight has been added altogether. The temperature must not rise above 5 deg. C. during this addition. After standing a few hours, the separated nitro-compound is collected on an asbestos filter, washed first with concentrated nitric acid, then with dilute nitric acid of gradually diminishing strength and finally with water. It is then extracted with hot alcohol, in which it is not appreciably soluble.

REAGENTS FOR DETECTING LEAD

Lead.—The only sensitive reagent for the detection of lead is tetramethyldiamino-diphenylmethane, which gives a blue color with lead peroxide. The latter is obtained from lead hydroxide by oxidizing it with hydrogen peroxide and ammonia and removing the excess. Traces of lead are determined generally by a colorimetric method depending upon the production of brown or black lead sulphide.

When examining textile fabrics, the material is burnt to an ash or oxidized completely with nitric acid. The ash is extracted with a warm solution of ammonium acetate which dissolves lead readily. The extract is diluted to a definite volume and an aliquot part is treated in the following manner:—The liquid is placed in a Nessler cylinder and a little potassium cyanide solution added. The mixture is next made alkaline with ammonia, after which some freshly prepared sodium sulphide solution is added and the contents of the cylinder mixed. In presence of lead a brownish or black color is produced, due to the formation of lead sulphide.

Iron and copper give a similar color, but they form double cyanides which are not decomposed by sodium sulphide. The color of the liquid is now matched with a standard solution containing 0.0001 grm. of lead per c.c. Water, potassium cyanide, ammonia and sodium sulphide are placed successively in the cylinder and the diluted lead solution run in until the color matches that of the first cylinder. The stock solution of lead which is diluted for use is made by dissolving 1 grm. of pure lead foil in nitric acid, evaporating the solution to dryness, and dissolving the lead nitrate in 1 litre of water.

PRESENCE OF CHROMIUM

Chromium.—Soluble chromium salts or bichromates are found sometimes in dyed goods, and may cause skin irritation. The fabric to be tested should be extracted several times with boiling water, the united extracts filtered, evaporated to dryness and burnt to an ash. If the ash is green, the presence of chromium is established. But the absence of a green color does not necessarily prove the opposite. The borax-lead test may be applied to the ash. Even traces of chromium will give the characteristic green color. In order to confirm the presence of chromium and determine the quantity, the ash is mixed intimately with magnesia and a little potassium carbonate and ignited, over a Bunsen burner or in a muffle furnace for some time, the contents of the dish being stirred occasionally to expose a fresh surface to the air. The chromium is converted into potassium chromate, the magnesia preventing the mass from fusing. After cooling, the contents of the dish are dissolved in dilute hydrochloric acid, some potassium iodide is added, and the liberated iodine titrated with decinormal or centinormal sodium thiosulphate solution. Each cubic centimetre of decinormal sodium thiosulphate used corresponds to 0.00173 grm. chromium.

The Dyeing Machine—II

(Continued from page 420)

The modifications and variance of one machine from another are the results of effort to overcome the defects of the simple machine in its relation toward dyeing certain materials or in its relation toward the application of certain dyestuffs by such mechanical means.

Skein and Raw Stock Dyeing

Much dyeing is done in the skein and in the raw stock, and many abortive attempts marked the early efforts at building productive mechanical devices to handle this work. Much of instruction can be gained from a study of these attempts and they are also interesting and often times amusing.

Finally, in our country, there was developed a dyeing machine of more than ordinary importance. This was the Klauder-Weldon Dyeing Machine. Although interesting, we cannot include here a history of that development, more than to state that it was a practical application of an old idea or principle. That principle was that the material held in a perforated cylinder or a skein held at the periphery of a wheel, which wheel or cylinder revolved in the dye solution, would be kept in constant motion in its passage through that solution and would, therefore, permit of uniform dyeing. In short, the material was dragged through the solution.

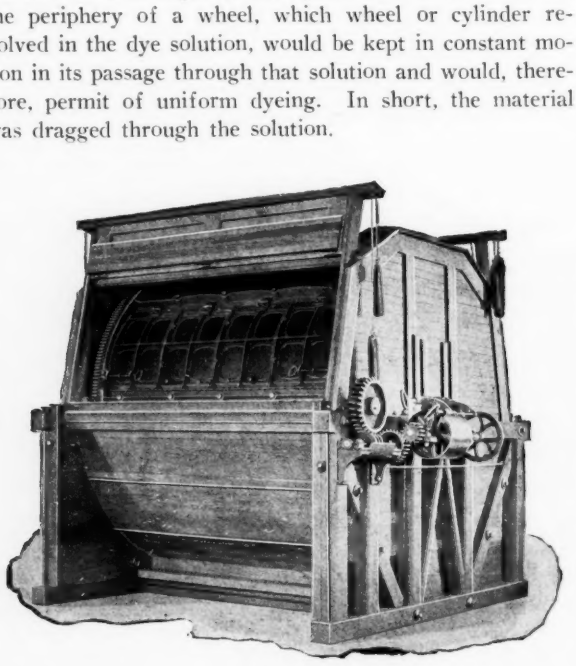

Fig. 20
Delahunty Dyeing Machine.

Other machines of like principle and modified only by mechanical changes designed to remedy or overcome apparent defects inherent in the rotary machine found favor in many sections of the country. Of these the Delahunty Dyeing Machine and the Giles Dyeing Machine are the most outstanding, although many independent machine shops in the large textile centers have contributed to the improvement of the operating mechanism.

Rotary Machine

It is interesting to note the general plan of design and operation of the rotary machine. In the case of loose or raw stock the machine cylinder is divided into four compartments which are loaded through doors across the cylinder and equal in width to that segment. The stock is packed in by hand. The stock is pulled out by hand. The labor, while less than in the operation of the hand tub is excessive. As the cylinder revolves there is a tendency for the stock to "roll" or "pill" and with excessive steam the stock becomes "felted" and "matted." Coloring is not in all cases satisfactory, but the machine is used for want of better and the demands of production. Some dyehouses use this type of machine today for dyeing raw stocks, rags, and other loose material, and they state it yields them satisfactory and reliable results. Its simplicity commends it for operation by unskilled labor. Per pound

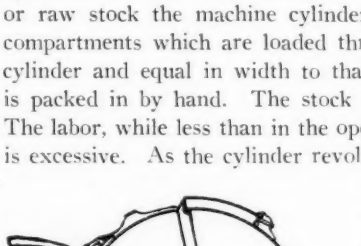

Fig. 21
Sectional View of Klauder-Weldon Raw Stock Machine.

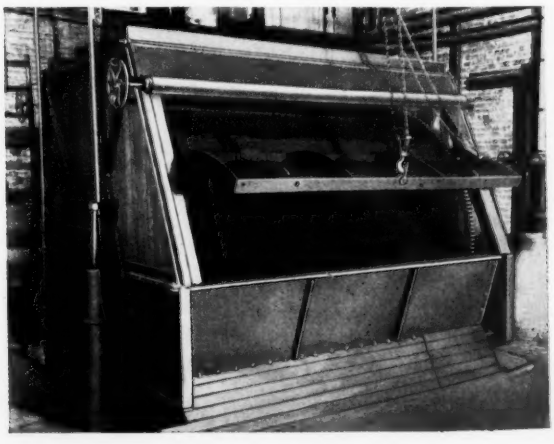

Fig. 22
Butterworth Raw Stock Machine.

of material dyed the steam consumption is greater than in a well regulated open hand tub.

The executive will do well to remember:

1. That the steam consumed is equal to and often in excess of that required by the same poundage of hand work.
2. That labor is slightly to the advantage of the machine.
3. That excessive amounts of metal tend to excessive repairs, and influence the tone and the shade of dyeing in many instances.
4. That felting, rolling, tangling or matting results with average stocks.
5. That some special work can be done to advantage, particularly any work requiring aeration, as the perforated cylinder is constantly exposed to the air.

The Klauder-Weldon skein machine has a better reputation, and, in fact, the word Klauder-Weldon and skein dyeing machine became synonymous both at home and abroad until the circulating machines, especially the Hussong Dyeing Machine, supplanted it in favor. This machine was mounted on a reel which carried on its periphery a means of securing the dyesticks, and inward nearer the core of the reel another like box for carrying a second stick. The yarn is placed on and held tightly between this inner and outer stick. On the socket or box of the outer stick is a star wheel with a ratchet and a pawl. As the main cylinder rotates this star wheel engages a trip which forces it around one-quarter turn, which in turn moves the position of the skein on the stick, and at the same time the skein is being forwarded through the bath or dye-liquor. At the rear of the kettle is a false back built out from the kettle proper some 6 inches to 8 inches. At the base of this but just inside lay the steam pipes. Their function is to create a circulation as well as to heat the bath, and their location to the false back is intended to act as an injector.

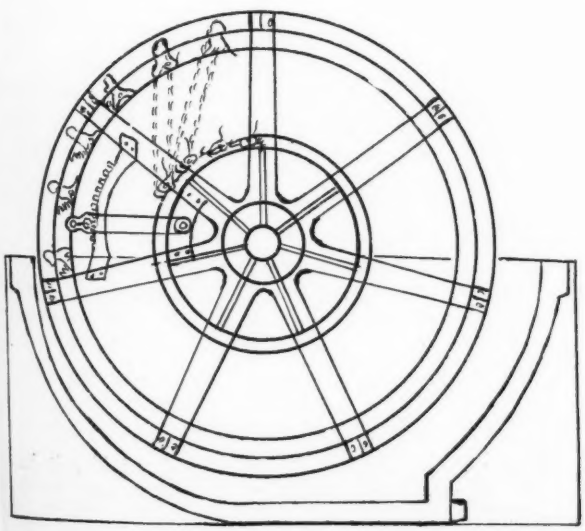

Fig. 23
Sectional View of Yarn Rotary Machine.

Fig. 24
Ratchet and Pawl.

This machine does some very nice work when properly handled and has enjoyed a wide field of activity. The skeins held tightly, as they are, between two sticks, are some claim to advantage in certain types of dyeing, but this feature is of doubtful advantage in other classes of work. The machine is yet in wide general use and well known to the dyers. It should be remembered:

1. That the steam consumption is about the same and in some instances greater than the hand kettle.
2. That small ratchets, springs, and other metal parts call for frequent replacement.
3. That the steam circulation should be checked to see that it functions.
4. That the trip must turn stick, and skein must turn on the poles.
5. That skein must be uniform in length.
6. That good work on machine is absolutely dependent upon maintaining the machine in perfect order and uniform skein length.

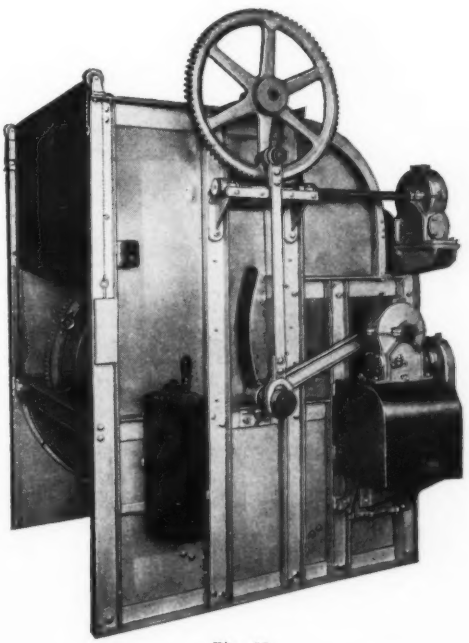

Fig. 25
Butterworth Skein Machine, Hoist Type.

Hussong Machine

The next type of machine to engage the serious attention of the dyeing world was a machine perfected in principle only by its inventor but developed by its subsequent manufacturers to a dependable dyeing apparatus. This was the Hussong Dyeing Machine. The machine was radically different in principle from other developments

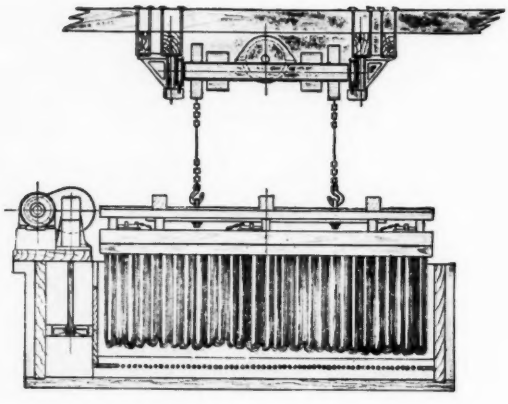

Fig. 26
Sectional View of Hussong Dyeing Machine

and an understanding of the principle upon which this machine is based is of importance.

The machine consists of a rectangular vat divided by a partition at one end which forms a well-hole, in which well-hole is located propellers. By rotating these propellers the circulation is forced over the top of the partition board or through the opening at the bottom of the partition board, depending upon the direction of rotation. In the case of stock or loose material the coloring is done in a cage divided into suitable compartments or open throughout as desired, but with doors top and bottom. This cage, when in position in the machine, rests upon cleats forming a part of the sides of the vat and at a height equal to the opening in partition board. The cage sides are solid but the doors top and bottom are perforated so

Fig. 27
Hussong Dyeing Machine.

that the circulation can proceed in either direction. The stock is not packed tightly in the cage as the machine depends upon a forced percolation and the mass of stock adjusts itself uniformly, if free to do so, to the uniform pressure set up by the propellers and no channels will develop, and consequently no over-dyed stock will result. The steam pipes are located in the bottom of the vat. After dyeing the entire cage is raised by a hoist, and by releasing the bottom doors the entire load is dropped before the extractor or other suitable place. The entire dyeing is done under the solution and the machine has a

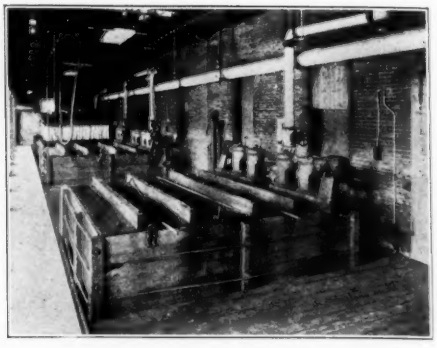

Fig. 28
Hussong 1,000-lb. Skein Dyeing Machine.

cover. Repairs are very rarely required, as the mechanical features are all located, with the exception of the propellers, on the outside of the machine away from all chemical action.

The major points of interest concerning this machine are:

1. The machine offers tremendous economies in steam.
2. The machine offers, if installed in battery, large labor economies.
3. The machine delivers a "lofty," "open," and "free" stock which is very difficult of duplication by other methods of dyeing.
4. The machine must not be overloaded.
5. The machine must be operated at a constant and proper propeller speed.
6. No obstruction must be placed in the circulation.
7. If belt driven, care must be exercised to see that no clutch slippage develops.

The Hussong skein machine is constructed very similarly to the raw stock machine, in fact, with but slight alteration the one may be converted into the other. The yarn to be dyed is placed on a stick very much the same as a hand kettle stick, except that it is made to fit slotted holes in a yarn rack, which rack with its entire load of loaded sticks is placed in the machine. The yarn being only on one stick is free to move with the circulation and in fact uniform dyeing depends upon the upward flow of the circulation carrying the yarn off the stick. A false top to the rack holds the yarn submerged at all times. A false bottom protects it from the steam pipes, while the partition board prevents entangling with the propellers. The rack carries with it a cover to prevent steam escapement. As with the cage of stock machine the rack with its load of yarn is raised, lowered or transferred by means of a hoist. The summarization of important facts are the same as with the stock machine, suitable and constant propeller speed being essential to satisfactory work.

Circulation Machine

Since the development of the first closed kier it has been the ambition of many to dye material under forced circulation. Innumerable attempts have been made, some of which met with success with certain particular mate-

rials or when using certain particular dyestuffs. That the day is close at hand when a machine will be developed that will meet all requirements with certain modifications is not to be doubted.

Obermaier, Dreze-Michaelis, Schmidt, Haubold, Porintz and others on the continent and Rhodes and Mather-Platt in England early in the development of machine dyeing brought forth dyeing apparatus based on this principle and differing one from another in mechanical application and in design. These pack systems or pump circulation machines as they are variously designated by the trade were introduced into this country for one form of dyeing or another, but met with no great success. In this country there was developed based upon this principle several machines, many of which have already passed into oblivion and others which have become obsolescent by the more advanced design and improvement of competitive types. The Psarski Dyeing Machine and the Uniform Dyeing Machine were two of the most outstanding of original developments, and each had certain commendable points. At about the same time as these developments two other forced circulating or pack machines appeared, the Chattanooga Dyeing Machine and the Franklin Process Machine. The Chatanooga machine was made to color large amounts of raw cotton. A circular cast iron vat with perforated bottom was filled with cotton stock. A perforated metal grid or cover held the stock in place and the circulation was gained by means of pump. Delahunty machine was produced in competition. A rectangular cast iron vat was fitted with a mechanically operated upper grid which could be raised or depressed by means of a screw. The circulation was by pump. These machines will be frequently met with and do passable work when the stock is to be further blended and mixed.

The Franklin Process Machine has been developed to a very high degree and many of the difficulties experienced with earlier types of pump circulation systems have been eliminated. Here the material whether stock or yarn is held in a fixed position and the dye circulated through it at considerable pressure. The machine is tightly closed and no steam escapes. In the yarn machine, the yarn is wound on a special spiral spring, and in the form of a package goes through the entire dyeing process, which appeals to many, and which no doubt can be economically handled when the mill is equipped with proper winding frames. That the winding bears an important part in the success of the work is a recognized fact. In all machines of this type with forced circulation, the velocity of the solution as regard the mass (the stationary material being colored) is so great that there is a marked tendency for any solid matter to be precipitated. That is filtration of the dyestuff will occur under certain conditions.

The Franklin Process Machine is adaptable for (1) fine single and ply yarns for shirtings and dress goods, warp and filling; (2) worsted single and ply yarns on jack-spools for suitings; (3) cotton pile yarns for fancy plushes; (4) cotton pile yarns (vat colors) for washable rugs; (5) fast color yarns, warp and filling, for towels and table covers and (6) for insulating yarns.

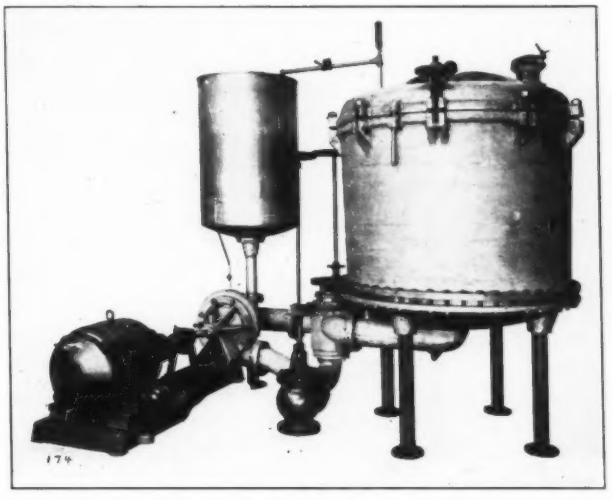

Fig. 29
Franklin Process Machine.

The Franklin Dyeing Machine has been quite successfully adapted to raw stock dyeing. The machine is covered to prevent steam escapement. And the stock can be taken from the machine by means of a hoist, so the

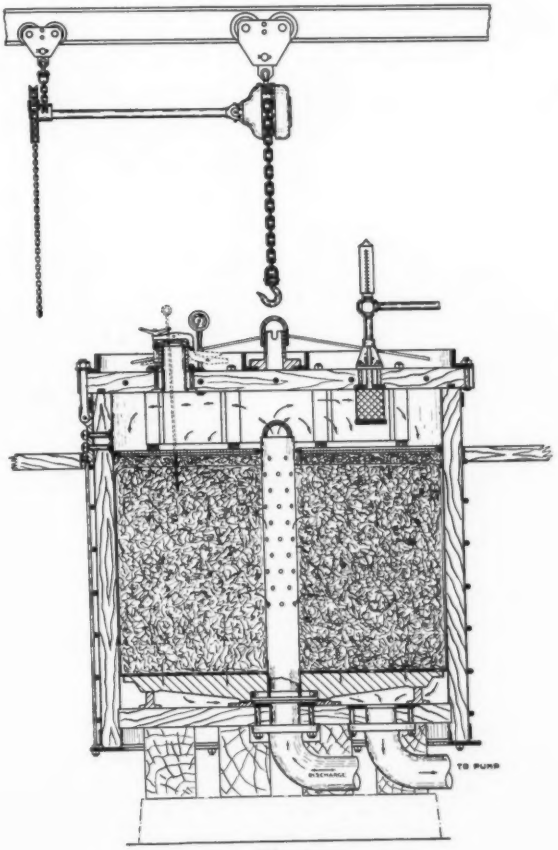

Fig. 30
Sectional View Franklin Raw Stock Machine

manual labor is minimized. But, as in all circulating machines of this type, there is a tendency to channel and over or under dye in spots. Where large blends are being laid down this is not of great importance, but it should be considered if exact dyeing is an essential factor in the manufacture.

Beam Dyeing

Beam dyeing machines have found quite an extensive use in the cotton industry and they operate upon this same principle. The warp is wound on a suitable perforated spool and any where from four to six of these large spools are dyed at one time. The installation cost of the equipment is heavy, and they are practical only when production can be maintained. Thies Dyeing & Processing Co. of R. I., American Obermaier Co., Brantwood & Sons have representative installations in a number of American plants.

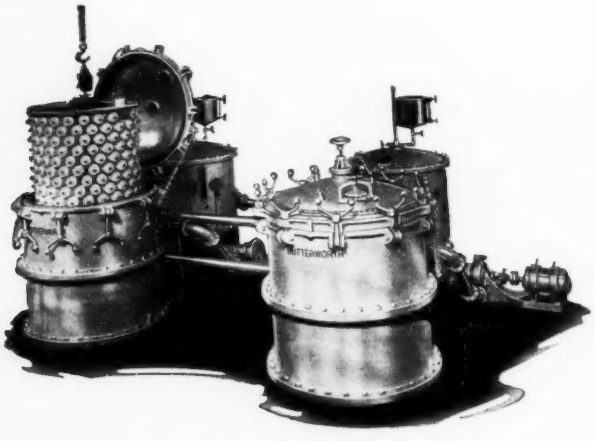

Fig. 31
Butterworth Beam Dyeing Machine.

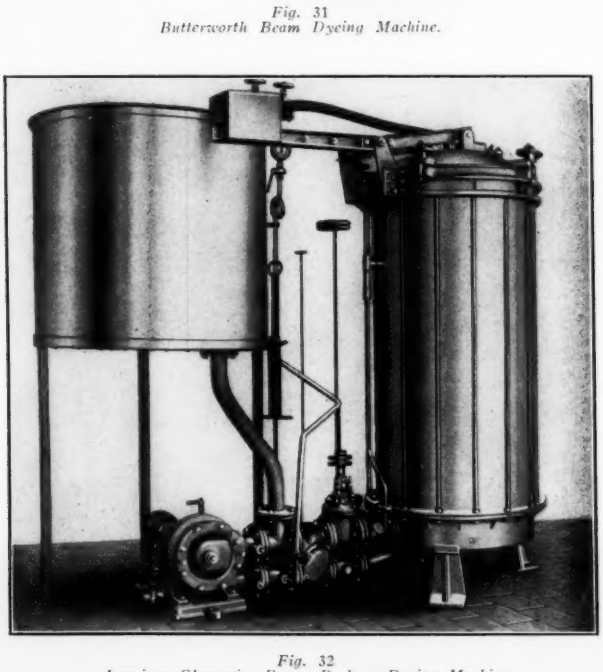

Fig. 32
American Obermaier Rayon Package Dyeing Machine.

Another machine of distinctive principle is the Haskell Continuous Dyeing Machine. This machine is worthy of further study. The machine was designed for warp dyeing of long or short chain yarns and combines the advantages of the concentrated or "short" bath of the Scotch tub and the longer period of immersion of the continuous machine of several consecutive tanks. The dye bath is subject to little agitation and is protected from the air. The distinctive feature is the complete circulation, which is automatically gained by the yarn in its passage through the machine and without the use of any circulating device. The wash compartment is a unit complete in itself, and the wash water flows in an opposite direction to the movement of the warp and thus the warp enters the squeeze rolls from the cleanest water.

Hosiery Dyeing Machines

While no new principle is involved, the paddle and cylinder hosiery dyeing machines deserve mention. The

Fig. 33
American Laundry Machine Hosiery Dyer.

paddle machine consists as its name implies of a paddle which is designed to maintain the liquor in the kettle in a state of constant but moderate agitation. The wheel is placed horizontally across the kettle and is generally divided into four segments. As the wheel rotates the agitation is set up. In the cylinder or laundry type machine a perforated cylinder divided into compartments is made to revolve in a vat holding the dye-liquor. The material is entered and withdrawn through doors in the cylinder. The direction of rotation of the cylinder reverses automatically.

Reference has already been made to reel skein machines of which the Buhlmann and Smith Drum machine offer complete illustration. (See illustrations in previous issue.) The machine consists of a series of mechanically rotated arms extending over the dye compartment and on these arms the skein yarn is placed and

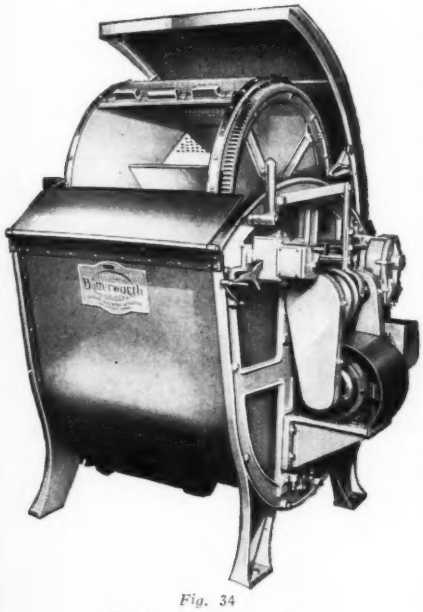

Fig. 34
Butterworth Hosiery Dyer.

rotates in an endless belt thru dye solution. Arrangement is made to raise or lower thearms as desired. Advanced engineering has perfected this type of machine to a high degree of effectiveness, and it finds a very welcome place in many dyehouses where it eliminates much of the former drudgery and loss in time in turning out small lots, of various colors.

Of course, there are machines other than those mentioned but these reviewed have reached a high mechanical perfection and are so intimately associated with a distinctive principle, which may or may not have been entirely original with their present manufacturers, but, nevertheless, have been a product of their unceasing effort that they stand alone. Many have observed with rapaciousness the increasing trade of these companies and many have been the imitations and modifications attempted to circumvent patent rights or to create a selling point. And small has been the benefit to the textile manufacturer or dyer. The effort used in these piratical trade invasions would, if intelligently applied, perfect some worthwhile individual and distinctive dyeing machine.

Summary

We have then the following distinctive principles underlying dyeing machine construction:

1. Hand tubs or kettles depending upon manual operation.
2. Rotary type of machine such as Klauder-Weldon, Giles, Delahunty, where the material is dragged through the solution.
3. Rotary type such as laundry washer type where the cylinder reverses its direction at regular intervals.
4. Reel type such as cloth piece dyers and skein yarn dyers of Buhlmann and Smith Drum.
5. Paddle type where agitation is set up by a paddle wheel.
6. Hussong type or forced percolation.
7. Haskell type or counter flow continuous type.
8. Continuous machine such as jigs, padders, warp yarn, slubbing and other continuous methods.
9. Pack systems or forced circulation machines.
10. Printing in its various forms.

The textile executive should, besides acquainting himself with the general principles underlying the various types of dyeing machines now in common usage, further inform himself exactly regarding the following subjects as related to his own dyehouse and if possible make comparison with others in similar line of work:

1. Quality of work.
2. Machine upkeep.
3. Redyes.
4. Steam consumption.
5. Labor required.
6. Power required.
7. Water used.
8. Floor space required per pound dyed.
9. Special building construction required.

The quality of the work is of first importance. The proper equipment might lead to a material improvement in quality.

Machine upkeep is more significant than mere replacement costs. It may mean lowered quality or excessive redyes and certainly is the cause of much lost production, because no machine can function properly if in a continual state of disrepair.

Redyes may be cased by the dyer's inability but more than likely from improper machine design or functioning.

Steam conservation has an important bearing upon all dyehouse costs.

Labor, likewise, is a major item in dyehouse expense.

Power is a small expense but should be conserved.

Water in some parts of the country is not only costly but the supply must be safeguarded. Therefore, equipment economical in the use of dye-liquor should at least have favorable consideration.

Floor space demanded by equipment is often excessive in relation to the poundage delivered, and certain installations are much more economical than others.

Special building construction may be the aftermath of hasty choice of dyeing equipment, or in replacements much economy can often be gained by the proper choice of equipment.

But withal do not forget that the first and only reason for equipping with dyeing machines is to do dyeing, that is, the exact coloring of your product. The economies in labor, steam, etc., may be powerful attractions to the choice of a particular machine, but it is the quality of your dyeing that should have your most careful consideration.

With intelligent interest and with particular attention to the problems of the dyehouse and dyeing machinery every textile management holds the position of arbiter over the future of dyeing machine development. Such manifest interest coupled with cooperative action with the machinery builders would soon stimulate productive activity in this direction and the dyehouse equipment would shortly become comparable to the high perfection and precision of other mechanical devices of the textile industry.

Technical Notes from Foreign Sources

Vat Dyestuffs (Dibenzanthrone Series)

German Patent No. 440,890 (28/*XII*/'24) (*addition to G. P. No.* 412,053 *of* 13/*X*/'22)—*I. G. Farben-Ind. A.G.*—The original patent has already been modified by a supplementary one, G. P. No. 423,282, to cover the application of the Friedel-Crafts reaction, with aliphatic or aromatic acid chlorides, to derivatives of benzanthrone substituted in the 1-1′ position. The present supplement covers the extension of the Friedel-Crafts reaction with the above chlorides, in presence of oxygen or halogen, to dibenzanthronyl or dibenzanthrone, or their derivatives, except those substituted in the 2-2-bz position. Two examples are given, one covering a product dyeing cotton pure blue from a blue-violet vat, and the other dyeing gray-blue from a violet vat. The tones are purer if the products are first treated with sodium hypochlorite.

Vat Dyestuffs (Dibenzanthrone Series)

German Patent No. 443,610 (24/*III*/'23)—*I. G. Farben-Ind. A.-G.*—German Patent No. 414,203 covers the use of certain hydroxydibenzanthrones, dyeings from which are not altogether fast toward acids. The present patent covers the alkylation or arylation of these products, giving dyestuffs of great fastness and a greater range of tones. Two examples are given.

Afterchrome Dyestuffs

German Patent No. 477,754 (2/*VIII*/'27)—*I. G. Farben-Ind. A.-G.*—The dyestuffs producible by the present procedure are basics of the triarylmethane series. An aldehyde is condensed with 1 mol. of an otho-hydroxycarbonic acid and 1 mol. of a heterocyclic compound containing a CH_2 or CH group capable of so reacting, to form the leuco-dyestuff, which is then oxidized as usual. Either of the possible methods may be used—condensation of the aldehyde with one component to form the hydrol, which is then condensed with the other component to form the leuco-compound, or the aldehyde may be condensed with the two components simultaneously, used in mixture, to form the leuco-compound directly. The dyestuffs produced, dyed upon wool, and afterchromed, give blues of excellent fastness—pure blue, reddish blue, and marine blue.

Indigoid Dyestuffs (Thio-indigo Series)

German Patent No. 450,852 (19/*X*/'27)—*I. G. Farben-Ind. A.-G.*—Naphthalene-3-2-(3′-oxy-1′-thiophene) is condensed with 2-anils of 2-3-diketo-dihydro-thiophene-benzene or its derivatives: or oxythionaphthenes or their derivatives are condensed with 2-anils of 3-2-(2′-3′-diketo-dihydro-1′-thiophene)-naphthalene. The products are then halogenated. The one example cites a dyestuff giving on wool or cotton, from the hydrosulphite vat, very fast, bright violet tones.

Dyestuffs Containing Chromium

German Patent No. 448,141 (9/*VIII*/'27)—*Gesells. f. Chem. Ind. in Basel*—Those o-hydroxy-azo-dyestuffs, which are produced by coupling between acetacetic acid derivatives and diazotized o-hydroxy-aminophenols, which latter contain one or more nitro-groups, but no carboxyl groups, are treated as usual with chromium compounds, which will introduce chromium into the molecule. Three examples are given. The tones produced upon wool are in the red-orange-yellow range, and are very fast and level.

Defects in Acetate Silk Goods

H. Brandenburger—Kunst-Seide 13,99 (1931)—Damaged spots or defects of almost any sort show up only on the finished goods, after dyeing. Oftentimes the defects are so slight, especially with goods dyed in dark, self-tones, that only the most experienced eye can detect them, yet they are there, whether recognized at once or on later continued observation. It is not an easy task at all, or either simple or in some cases even possible, to gain much information about the defects in dyed and finished goods. The author, therefore, is accustomed to strip the dyestuffs, by extracting a swatch in the Soxhlet, with absolute alcohol, which, as we know, is a good solvent for most substantive and developed dyestuffs, of the sorts used for acetate silk. It is possible by an extraction of reasonable length to remove practically all the dyestuff; a short extraction lightens the shade proportionally; and such a partial stripping often makes evident a defect, in a condition most suitable for study, more plainly than perhaps complete stripping would afford. When the goods are a mixed weave, containing acetate silk only as a component, the other fiber or fibers may be stripped also, by other means. But as acetate silk is probably the one fiber which is most liable to show defects, in dyeing; at least, the stripping of the acetate silk alone is usually all that needs to be done. When, in a mixed weave, the acetate silk has been stripped, its exact location in the weave is very easy, and fibers of it can quickly be withdrawn and subjected to microscopical examination and chemical testing.

Determination of the fact that defects occur is easy; determining the cause of the defect is quite otherwise. Oftentimes very exact and searching study will suggest only suspicions of the possible causes of the trouble.

Some defects, and the conclusions drawn from a study of them, may be of interest:—

a—Spotty dyeing of an acetate silk-viscose crepe; uneven dyeing because of local isolated saponification of the acetate silk during the crepeing process.

A similar defect in the same sort of goods; the same reason for the unevenness in dyeing, but due in the present case to something which happened in the latter part of the dyeing, as careful examination under the microscope showed the trouble to be only superficial, most of the substance of the fiber underneath the spots being dyed uniformly.

c—Spots due to spattering or dropping of some liquid upon the goods are usually easy to trace back.

d—Goods with a streaky warp; caused by use of different lots of acetate silk (particularly from different manufacturers), as proved by the difference in the acetylcellulose value of different isolated fibers. The explanation of this defect was admitted and the matter adjusted with the complainant, by the firm involved.

e—Investigation of several lots of spotty and streaky goods showed that insufficient removal of the finishing agent had been carried out before dyeing; not only was linseed oil, the source of so much trouble, to blame, but sometimes more simple finishing agents. Stripping, careful removal of the finishing agent, and redyeing, in some cases definitely located the trouble upon this basis. It is not always possible to rectify a defect so caused, in this way, however, because sometimes the acetate silk fiber has suffered fundamentally through the action of the finishing agent—the trouble has become deeper-seated, and is no longer merely superficial. One case of the sort in particular the author takes up in detail, because of its peculiar interest; his points are as follows:—the material was acetate silk-viscose crepe, with astonishingly regular streaks, almost stripes, in the acetate silk warp. Although the goods were deeply dyed, the distinction in tone between the body—and the "streak-" color was so pronounced, that it has been possible to reproduce it in the illustration (fig. 1). The author first suspected that the trouble was due to the use of acetate silk of different origins, but this on investigation proved not to be the case. In the course of the study, he stripped the acetate silk of the weave by the alcohol extraction method; but it appeared that the stripping was only partial; the stripped bands were of acetate silk, certainly enough, but the woof, and regular bands of the acetate silk warp as well, had retained the dark viscose dyestuff (fig. 2, a). Another swatch was so stripped, that the acetate silk warp was left dyed (fig. 2, b). "That it was not a case of an intermixing of the fibers of viscose and acetate silk within the yarn of the warp (which incidentally does sometimes occur), was proved by the appearance of the part stripped of the viscose dyestuff, in which there were acetate fibers lighter in color, but still tinted, and differing from the totally stripped fibers only in shade. A searching examination under the microscope showed that the acetate fibers which retained the dyestuff were superficially so strongly saponified, that they actually consisted of an internal dyed nucleus of acetate silk, and an outer layer of dyed, deacetylated acetate silk. All possible reactions were drawn into use, and all pointed consistently to the same conclusions. As the firm producing the goods stated, they had encountered difficulties from the very beginning of the manufacture of the goods, from different strongly oxidized linseed-oil finishing agents. The author then conceived the suspicion that possibly an insufficient removal of the finishing agent on these puzzling areas had taken place, or that, perhaps, through possibly too vigorous action of the de-finishing agents, the already completely definished acetate silk had suffered some damage. As answer to the first supposition, examination showed that no residue of linseed oil finish could be detected. As to the rest, the fact that the damaged fibers were dyed through proved the cause not to be what had been surmised. The nucleus of the filaments could not by any means have dyed through as it was dyed, and the external layer would have been forced to take up the acetate silk dyestuff rather than the viscose dyestuff, as was for the most part the case. As to the second possibility, the composition of the definishing baths proved that no case of any difficulty could exist at that point; and, further, the behaviour toward dyestuffs in such a case would have been other than what it was, and, finally, it was evident upon study that just those fibers which were covered with the linseed oil mixture were those which had suffered most damage. So that, as the last possible conclusion, there remained only the assumption that the strongly resinified linseed oil compound had attacked the acetate silk, and had superficially saponified it (it was a case of actual saponification, not of diminished luster or corrosion). Another case, very similar, of damage wrought with an acetate silk weave by resinified linseed oil compounds was studied and solved at almost the same time, the material coming from a different source. But the fastening of the trouble upon linseed oil finishing agents would perhaps not be sufficient to justify any decisive conclusion as to the suitability in general of such finishing agents for acetate silk. In order to avoid too premature a conclusion in these two cases, an exhaustive investigation of the whole question of such finishing agents has been undertaken."

The author has this investigation now under way, but it naturally will require some time before results sufficient for publication can be obtained, as the material to be studied is in storage for an extended period, in order to give the linseed oil mixture time to oxidize to the utmost. The question, at present unsolved, is the more interesting, because the patents covering the use of the agent in question are about to expire, when probably "everybody" will begin to employ the method.

The paper closes with a bit of advice whose purport might well be extended to anticipated difficulties in other fields; "the warning 'Care! Acetate Silk!' should not inspire a kind of fear, or any particular apprehensiveness, in the mind of the skilled worker, but only suggest to him through exercise of the greatest care innumerable troubles can be avoided."

Alteration in Dyeings through Cleansing with "Tri" *Deutscher Faerber-Ztg.* 67,762 (1931)—In the case

of an acetate silk garment suffering alteration in color (a specific case was the subject of inquiry), the dyeing was evidently a combination brown. The "tri" apparently extracted the red component most strongly. As to the printed pattern, such a dyeing may well be gotten to run off if almost any common dry-cleansing solvent is used, whether "tri" or any other, without the trouble having to be ascribed to incomplete fixation of the color. —With no ordinary cleansing solvent can one be sure that it will not attack some dyestuff on the fiber—simply dissolve it off. Oftentimes such trouble is plainly due to the use of basic dyestuffs. To be able to proceed with absolute safety, preliminary tests with the proposed solvents must be carried out, even though in most cases no trouble will be met with.

Another note (l.c.) upon the same question states—according to all signs, the cause of the alteration in color of the cleansed garments lies not in the use of "tri" as the cleansing agent, but in the benzine soap used; possibly the "tri" also contained much moisture. "Tri" attacks neither the dyeings nor the fabric (this is certainly not true for certain groups of dyestuffs, such as basics or some pigments applied by the disperse method; such dyestuffs, having only physical affinity for the fiber, could certainly be simply dissolved off by the "tri," acting merely as a solvent.) At the same time, acetate silk goods ought not to be exposed to the action of the solvent for more than 10 minutes (this does not seem consistent).

Still another note (l.c.) states—such alterations in color may be due to two different causes. Dyeings carried out with basic dyestuffs will be particularly attacked by a solvent such as "tri"—most of all, red dyeings. (The author of this note seems to speak as though he had the question of pure solubility in mind). Further, the lightening in shade and dulling in tone of the dyeings may be traced back to the use of a solvent containing water. The case of the black plush (referred to in the original query) is doubtless due to the use of a finishing preparation containing stearine, paraffine, or a similar substance; by too long working in the solvent, the finish was removed, causing the alteration in appearance as noted.

Notes Upon Bleaching of Artificial Silk

A. K.—Kunst-Seide 13,103 (1931)—In bleaching natural cotton, the process involves the removal of natural incrustations, the fatty and waxy substances, pectin, albuminous compounds, etc., and the fragments of the seed-capsules, which still adhere to the fiber. All of these have to be actually removed, possibly altered chemically or destroyed first, by the action of the kiering or the bleaching. The first group of impurities is taken care of by the kier-boiling with alkali; the seed-capsules, broken down mechanically and in chemical nature by the same process, are finally completely destroyed by the bleaching. But artificial silk is an already strenuously purified material. It is formed from disintegrated, perfectly bleached cell-substance, dissolved in a suitable medium with or without chemical change, reprecipitated in the spinning bath as practically pure cellulose, and no longer contains any impurities which deserve the name. The bleaching process is really confined to removing the oily matter from the yarn, matter which has been deposited on and in the yarn to facilitate its proper spinning; and, also, bleaching is necessary if the yarn is to be given a pure white appearance instead of being left with its "natural" creamy color. There are no impurities to be removed, in the strict sense.

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DYER

Six years' experience at bleaching and dyeing wool, cotton, jute and union raw stocks and yarns. Thoroughly experienced in all stages of carpet manufacture. Age, 26; married. Address: Classified Box No. 731, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

CHEMIST

Experienced in the manufacture and research of sulphonated oil, leather and textile specialties. References furnished. Address Box No. 737, American Dyestuff Reporter, 440 Fourth Avenue, New York.

POSITION WANTED

Superintendent or Dyer; twenty-five years' experience in all classes of piece goods, such as taffetas, celanese linings, garbardines, broadcloths, crepes, linens and all mixed goods. A thorough knowledge of all colors, and vat dyeing, continuous or jig. Held very important positions with two of the most up-to-date plants in the United States. Address Box No. 738, American Dyestuff Reporter, 440 Fourth Avenue, New York.

WANTED

Experienced administrative controller for large Dyeing and Finishing Company in New England. Applicants should have some technical training in dyeing knowledge of textile trade in all its branches, including control of Selling and Purchasing. In addition to administrative experience, it is essential that applicants should have some technical training in dyeing and finishing Cotton, Rayon and Acetate Silk goods. To a man of driving power, common sense and integrity this is a position of unique opportunity. Salary and commission on a generous basis to the right man. Applications, which will be treated as strictly confidential, stating age, experience and complete record to be addressed to Box No. 739, American Dyestuff Reporter, 440 Fourth Avenue, New York.